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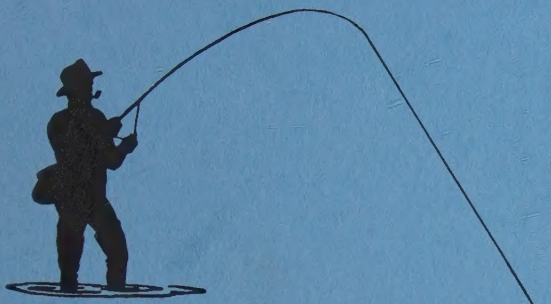

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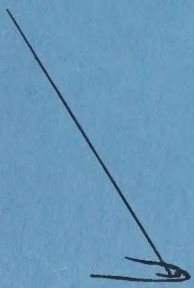

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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18787. Black, John J., and C. Lenore Simpson (Dept. of Exp. Biol., Roswell Park Memorial Inst., 666 Elm St., Buffalo, New York 14203). 1974. THYROID ENLARGEMENT IN LAKE ERIE COHO SALMON. J. National Cancer Inst., 53(3): 725-729.

Pennsylvania, New York, and Ohio introduced stocks of coho salmon, Oncorhynchus kisutch, into Lake Erie. Of 117 mature salmon examined during the 1972 spawning migration, 44% had grossly enlarged thyroids. Microscopic examination of the thyroids revealed marked hyperplasia. Local invasion was not considered evidence of neoplasia because of the diffuse nature of the normal fish thyroid. The presence of intravascular thyroid cells in one enlarged gland raised the possibility of superimposed carcinoma in some fish. (Authors' summ.)

18788. Claggett, F. G., and J. Wong (Dept. of the Environ. Environ. Protection Serv., Vancouver, Brit. Columbia, Canada). 1974. TREATMENT OF FISH PROCESSING PLANT WASTEWATER. Bull. Fish. Res. Board Can. No. 189, 18 p., illus.

During the processing of seafood, from 0.5 to 10 gal of water per lb of fish processed may be used for conveying, processing, and plant cleanup. The resultant effluent contains from 2 to 30 lb of organic solids per 1000 lb of fish processed. Despite the variety of approaches that regulatory agencies are taking in selecting standards, fish processing plants can expect to be required to supply some degree of treatment to their effluents. A review is included of some waste treatment methods which might be expected to apply in the fish processing industry. As most of the methods mentioned are either poorly suited to the industry or are expensive, we have studied the application of fine screening and dissolved air flotation. Data obtained from operation of a demonstration treatment plant indicates reduction of 25-40% in biochemical oxygen demand (BOD) and suspended solids can be achieved by fine screening, and a further 75% BOD and 95% suspended solids removed by chemical treatment and dissolved air flotation. These studies have also shown that if the solids recovered by the screens are marketed as fish meal, the value received will, in most cases, offset the cost of the screens. Solids for fish meal production can also be recovered from the sludge produced by air flotation, but the recovery is more difficult and expensive, and hence the value received will do little more than offset the operating costs of the treatment. (Authors)

18789. Sweeting, R. A. (Sir John Cass School of Sci. and Technol., City of London Polytechn., Jewry St., London EC3N 2EY, England). 1974. INVESTIGATIONS INTO NATURAL AND EXPERIMENTAL INFECTIONS OF FRESHWATER FISH BY THE COMMON EYE-FLUKE Diplostomum spathaceum Rud. Parasitology, 69(3): 291-300.

The range of fish hosts parasitized by Diplostomum spathaceum was assessed. Natural and experimental levels of infection were compared between host species. The accumulation of eye flukes with age was established in one host - Rutilus rutilus. Development of metacarcariae in lenses of naturally infected Gasterosteus aculeatus throughout the year was compared with that of experimentally infected South African clawed toads, Xenopus laevis, maintained at various temperatures (5-30°C). The importance of temperature changes to this part of the life-cycle of the parasite is discussed. (Auth.'s summ.)

18790. Sugisaki, Noriko, Marvin Welcher, and Carl Monder (Res. Inst. of the Hospital for Joint Diseases, Mt. Sinai School of Med., 1919 Madison Ave., New York, N. Y. 10035). 1974. LACK OF VITAMIN D_3 SYNTHESIS BY GOLDFISH (Carassius auratus L.). Comp. Biochem. Physiol., 49(4B): 647-653.

Goldfish (Carassius auratus L.) did not accumulate radioactive vitamin D in their visceral organs after they were injected with cholesterol-4-^{14}C, 7-dehydrocholesterol-4-^{14}C, DL-mevalonic acid-2-^{14}C, sodium acetate-1, 2-^{14}C and L-amino acid mixture-U-^{14}C. No conversion of DL-mevalonate-2-^{14}C to vitamin D_3 was detected over a 10-day period, whether the fish were maintained in the dark or continuously exposed to a fluorescent light. Almost all the radioactivity retained in viscera after injection of 7-dehydrocholesterol-4-^{14}C was sterol; none of the radioactivity which remained unprecipitated with digitonin was vitamin D_3. (Authors)

18791. Scott, D. P. (Dept. of the Environ., Fisheries and Marine Serv., Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1974. MERCURY CONCENTRATION OF WHITE MUSCLE IN RELATION TO AGE, GROWTH, AND CONDITION IN FOUR SPECIES OF FISHES FROM CLAY LAKE, ONTARIO. J. Fish. Res. Board Can., 31(11): 1723-1729.

Studies of large (about 125) samples of walleye (Stizostedion vitreum), northern pike (Esox lucius), white sucker (Catostomus commersoni), and lake whitefish (Coregonus clupeaformis) from each of four areas of Clay Lake, Ontario, a highly mercury-contaminated lake, have confirmed previous findings that the larger the fish, the greater the white muscle mercury concentration, within species, within populations. This relationship was statistically broken into separate age:concentration and growth:concentration partial regressions; older fish and faster growing fish were generally more contaminated, subject to the above species-area restrictions. However, the generally positive correlation between concentration and condition (as measured by relative heaviness of individuals within area-species samples) found in the previous study is here contradicted; relatively heavier fish tended to have lower Hg concentrations. Despite the relatively small size of the lake (about 11 x 2 km) analyses of multiple covariance indicated profound within-species differences between the samples from the four areas. However, there did not appear to be any obvious correlation between these differences and sediment mercury values. The various statistical relationships do not appear to be simple, first-order regressions; rather, there appear to be significant interactions between age and growth, and age and condition, which tend to change the partial slopes with age. The four species were distinctly different in most of their relationships. (Auth.)

18792. Davies, W. D. (Auburn Univ. Agric. Exp. Sta., Dept. of Fish. and Allied Aquacultures, Auburn, Alabama 36830). 1974. MANAGING SMALL IMPOUNDMENTS AND COMMUNITY LAKES. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 347-355.

Farm ponds and community lakes continue to attract a large number of fishermen. The manageability of these waters for increased fish production offers opportunities for substantial gains in terms of benefits to fishermen from management input costs. Intensive culture of channel catfish, tilapia and mirror carp can provide sport fishing opportunities, especially where fishing pressure is intense. Almost a ton of channel catfish per acre has been harvested by sport fishermen from intensively managed ponds. Problems associated with intensive culture are nutrition, disease, and the diminished aesthetics of fishing an intensively managed pond. Present management practices for bass-bluegill ponds are adequate, but intense study of optimum rates of exploitation and fertilization should provide for more efficient techniques. Strategy and tactics for the future should consider energy flow patterns in fish communities. Study of how these patterns are altered and what are the losses when fishing or other stresses are applied, should provide new management concepts. Stability in fish populations requires further study. In this respect, base-line data on stable and unstable multi-species fisheries need to be developed. (Auth.)

18793. Arnoldi, David C., William H. Herke, and Ellis J. Clairain, Jr. (La. Coop. Fish. Unit, La. State Univ., Baton Rouge, Louisiana 70803). 1973. ESTIMATE OF GROWTH RATE AND LENGTH OF STAY IN A MARSH NURSERY OF JUVENILE ATLANTIC CROAKER, Micropogon undulatus (Linnaeus), "SANDBLASTED" WITH FLUORESCENT PIGMENTS. Reprint: Proc. Gulf & Caribbean Fish. Inst., 26th Ann. Session, October, 1973, pp. 158-172.

Atlantic croaker constitute over half the industrial bottomfish landings from the Gulf of Mexico. Most length frequency studies indicate their mean standard length at 1 year of age does not exceed 130 mm but two recent papers dispute this. Project objectives were to determine juvenile croaker growth rates in the marsh and how long they remain there. About 90,000 croaker, from 10 to 40 mm standard length, were "sandblasted" with fluorescent pigment, and released, as they entered a marsh nursery. Recapture attempts were by trawling in the nursery and trapping at the outlet. Sixty definitely marked croaker were recaptured. These meager returns suggest individual croaker remain in the marsh only 1 to 4 months and grow about

14 mm per month. Croaker in industrial bottomfish landings generally range from 80 to 160 mm; thus most may be less than 12 months old. Also, turnover rate of croaker using the marsh may be high enough to make the industry dependent on maintenance of a viable marsh nursery. (Authors)

18794. Kothbauer, H., and H. Schenkel-Brunner (Zool. Inst. der Univ. Wien, Vienna, Austria). 1975. HEMAGGLUTININS IN FISH EGGS: COMPARATIVE STUDIES ON DIFFERENT SALMONIDAE SPECIES. Comp. Biochem. Physiol., 50(1A): 27-29.

Eggs of eight different salmonid species with known systematic position and relationship were tested for hemagglutinin activity against normal and enzyme-treated human A_1, B and O erythrocytes. The specificity was found against: (a) untreated erythrocytes: four species being anti-B, four species negative; (b) enzyme-treated erythrocytes: five species agglutinated all cells used - irrespective of the blood group, one species weak anti-B, two species negative. The hemagglutination spectra agree with the systematic relationship within the salmonid species tested. (Authors)

18795. Seliger, H. H., and M. E. Loftus (McCollum-Pratt Inst. and Dept. of Biol., The Johns Hopkins Univ., Baltimore, Maryland 21218). 1974. GROWTH AND DISSIPATION OF PHYTOPLANKTON IN CHESAPEAKE BAY. II. A STATISTICAL ANALYSIS OF PHYTOPLANKTON STANDING CROPS IN THE RHODE AND WEST RIVERS AND AN ADJACENT SECTION OF THE CHESAPEAKE BAY. Chesapeake Science, 15(4): 185-204.

It is possible to make statistically significant comparative measurements of similar sections of subestuaries under conditions where the large natural variations would mask all but drastic changes in the systems if they were studied individually. The comparative study is proposed as a modification to the baseline study of a single system for the assessment of the effects of man's activities in an estuary. We have made temporally coincident measurements of phytoplankton production, standing crops and a range of physical and chemical parameters in comparable sections of the Rhode and West rivers and in an adjacent section of the Chesapeake Bay for the 3-year period 1970-1972. We analyzed the data for standing crops and demonstrated that at least at the trophic level of phytoplankton, the judicious application of a paired comparative sampling protocol to the Rhode and West rivers is superior to a study of either system alone. We calculate that the paired comparison sampling protocol requires approximately one tenth the sample size of the single-system sampling technique to achieve the same significance level. (Authors)

18796. Eisler, Ronald (Natl. Marine Water Qual. Lab., U. S. Environ. Protection Agency, West Kingston, Rhode Island 02892). 1973. ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS. Natl. Environ. Res. Center, EPA-R3-73-007, Ecological Res. Series, 287 p. Price $3.20 domestic postpaid from Supt. of Documents, U.S. Govt. Printing Office.

A total of 567 references on biological effects of metals to aquatic organisms were annotated and subsequently indexed by metal and by taxa. Preference was given to articles on toxicity of heavy metals to marine, estuarine, and anadromous species. (Auth.)

18797. Houston, A. H., and D. Cyr (Dept. of Biol. Sciences, Brock Univ., St. Catharines, Ontario L2S 3A1, Canada). 1974. THERMOACCLIMATORY VARIATION IN THE HAEMOGLOBIN SYSTEMS OF GOLDFISH (Carassius auratus) AND RAINBOW TROUT (Salmo gairdneri). J. Exp. Biol., 61(2): 455-461.

Significant increases in total haemoglobin concentrations, and microhaematocrit values were associated with acclimation of rainbow trout and goldfish to increased temperature. Goldfish held at 2°C were characterized by two haemoglobin components, whereas those acclimated to 20° and 35°C exhibited three. Nine haemoglobin variants were observed in trout at 2°, 10° and 18°C. The data provide evidence that both species selectively alter the concentrations of specific haemoglobin fractions during the thermoacclimatory process. (Authors' summ.)

18798. Conroy, D. A., and G. C. Withnell (Fish Pathology Unit, The Zoolog. Soc. of London, London N.W. 1, England). 1974. THE USE OF A SLIDE AGGLUTINATION TEST AS AN AID IN THE DIAGNOSIS OF VIBRIO DISEASE IN FISH. Riv. It. Piscic. Ittiop., 9(3): 69-74.

The authors report studies on the use of a polyvalent agglutinating antiserum prepared from sheep in the diagnosis of Vibrio anguillarum infections in fish. Two separate polyvalent antisera were prepared using eleven strains of V. anguillarum and five strains of Aeromonas liquefaciens respectively. The antisera were tested against strains of V. anguillarum, A. liquefaciens, A. salmonicida and Pseudomonas spp., with or without absorption, by slide and tube agglutination techniques. Administration of V. anguillarum antigens to sheep led to the production of encouraging serum titres, and the absorbed polyvalent antiserum produced gave consistently good slide agglutination responses when tested against strains of V. anguillarum. Few cross-reactions were observed against aeromonads and pseudomonads when the antiserum was absorbed. The injection of fresh isolates of V. anguillarum into sheep mean that the polyvalent spectrum of the agglutinating antiserum can be constantly increased. The authors conclude that the slide agglutination test using polyvalent sheep antiserum is a valuable additional test for the tentative diagnosis of vibrio disease in fish due to V. anguillarum.

18799. Otto, Robert G., and John O'Hara Rice (Industrial Bio-Test Laboratories, Inc., Northbrook, Illinois 60062). 1974. SWIMMING SPEEDS OF YELLOW PERCH (Perca flavescens) FOLLOWING AN ABRUPT CHANGE IN ENVIRONMENTAL TEMPERATURE. J. Fish. Res. Board Can., 31(11): 1731-1734.

Groups of yellow perch (Perca flavescens) were acclimated to constant temperatures of 10 and 20 C. Acclimation temperatures were then abruptly reversed. Critical swimming speeds were determined prior to and following the temperature change at 24-h intervals. Adjustment (acclimation) of fish subjected to an increase in temperature was immediate. Fish subjected to a decrease in temperature required less than 24 h to regain maximum swimming capability. (Authors)

18800. Garvin, W. F. (Water Resources Research Inst., Oregon State Univ., Corvallis, Oregon). 1974. THE INTRUSION OF LOGGING DEBRIS INTO ARTIFICIAL GRAVEL STREAMBEDS. Completion Report No. WRRI-27, 79 p., available from NTIS, Springfield, Va. 22161 as PB-237 072, $4.75 paper copy, $2.25 microfiche; Selected Water Resources Abstracts, 8(2): p. 51.

The objective was to describe quantitatively the intrusion of logging debris into artificial gravel streambeds during conditions of low stream flow with a stable streambed, and begin an analysis of the effect of high flow and unstable streambeds. Prior studies indicated that logging debris was responsible for dissolved oxygen reduction within the gravel bed of spawning streams. Low flow-stable streambed studies were conducted for eighteen to twenty days in a flume. Two high flow studies were also conducted. Samples were subdivided vertically into three sections and analyzed for pore volume, solid volume, and organic material present. Quantitative changes in organic material in each section of a sample were determined. These changes were compared with the depth of the sample, organic size class, position of the sample horizontally from a datum point, time, porosity, solid and pore volume, and rainfall during sampling days. Significant variables influencing intrusion were found by multiple regression analysis. The best predictive equation had a multiple correlation coefficient of .1879. The range of debris concentrations of the two deeper sections for both low flow studies were .07 gm/l and .15 gm/l respectively. The average concentration values for both low flow studies were .03 gm/l and .02 gm/l respectively. No variables in the high flow study were found to be good predictors of intrusion. The range of concentrations of the two high flow studies were .14 gm/l and .04 gm/l respectively.

18801. Herricks, Edwin E., and John Cairns, Jr. (Biol. Dept. and Center for Environ. Studies, Virginia Polytechn. Inst. and State Univ., Blacksburg, Va. 24061). 1974. REHABILITATION OF STREAMS RECEIVING ACID MINE DRAINAGE. Bull. No. 66, Virginia Water Resources Research Center, Va. Polytechn. Inst. and State Univ., Blacksburg, Va. 24061, 284 p.

18802. Fleener, George G. (Missouri Dept. of Conservation, Columbia, Missouri 65201). 1974. MISSOURI'S APPROACH TO STREAM RESOURCE MANAGEMENT. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 356-373.

Despite continued deterioration and outright destruction of many streams Missourians still have a notable and diverse stream resource. Nearly 9,900 miles of permanent streams and 8,200 miles of intermittent streams with permanent pools remain. Positive stream management practices and activities in Missouri include water quality surveillance and control, access site acquisition and development, stocking for put-and-take trout fishing, National Scenic Riverways designation, commercial fishing on some larger rivers, and continuing research projects. Three examples of application of research to stream resource problems are discussed. The first is an evaluation of gigging for rough fishes. On Big Piney River, it was shown that giggers had catch rates up to 22 times higher than hook-and-line anglers. The harvest by gig, expressed as pounds per acre, nearly equalled the average annual harvest by anglers. This regulation allows a substantial harvest of suckers which comprise most of the standing crop of stream fish. The second example is an evaluation of a 12-inch minimum length regulation on black basses in Big Piney River. There was little change in estimated man-hours of fishing, after initiating the length limit, except for an increase in the last 2 years (1971 and 1972). The harvest of black basses declined from 2.9 to 2.5 pounds per acre during the 10-year study. However, the total fish harvest increased due to increased harvest of other centrarchids. The total number of black bass caught, including those released, nearly doubled. Similar results are evident in a 12-inch bass length study in progress on Huzzah Creek. Because of the favorable results of these studies, including good angler acceptance, sustained total harvest, high catch rates, and good black bass angling, a statewide 12-inch minimum length limit on black bass in streams will be initiated January 1, 1974. The last example is a measurement of the total recreational use of a stream. This study was conducted on a small stream in northwest Missouri that was threatened by channelization. Approximately 96,500 recreational trips, totaling over 348,000 man-hours, occurred in a 1-year period on a 57-mile section of this stream. Fishing pressure alone was 420 hours per acre, severalfold greater than the fishing pressure measured on other Missouri streams. Eleven types of hunting and eight non-consumptive recreational uses also were measured. Subsequent to the study, a standoff occurred between the U. S. Army Corps of Engineers and the Platte River Drainage District. In July, 1973, a Corps spokesman said the project "out of the question" because of its probable adverse effects on Platte River. (Auth.)

18803. Joy, James E. (Dept. of Vet. Parasitol., Coll. of Vet. Med., Texas A&M Univ., College Station, Texas 77843). 1974. INCIDENCE AND INTENSITY OF Spirocamallanus pereirai (NEMATODA: CAMALLANIDAE) INFESTATIONS IN THE CROAKER Micropogon undulatus (Linneaus) AND SPOT, Leiostomus xanthurus Lacepede, FROM TEXAS. Contrib. Mar. Sci., Vol. 18, pp. 1-6.

From September 1970 to August 1971 the nematode Spirocamallanus pereirai was found in the digestive tracts of 266 of 516 (51.5%) croaker, Micropogon undulatus (Linnaeus), and 172 of 512 (33.6%) spot, Leiostomus xanthurus Lacepede. Spirocamallanus pereirai females predominated over males by a ratio ranging from approximately 6:1 to 1.8:1 in every monthly sample of both host species. Seasonal patterns in incidence and mean number of S. pereirai per host for both host species were evident. The incidence of parasitization by S. pereirai declined as the length of croaker and spot increased. The mean number of S. pereirai per croaker was variable when related to host length, but increased in spot hosts up to 179 mm in length. (Auth.)

18804. Anees, Munawar Ahmad (Bait-ul-Fazal, Darul Rehmat Sharki, Rabwah, District Jhang, Pakistan). 1974. CHANGES IN STARCH-GEL ELECTROPHORETIC PATTERN OF SERUM PROTEINS OF A FRESHWATER TELEOST Channa punctatus (Bloch), EXPOSED TO SUBLETHAL AND CHRONIC LEVELS OF THREE ORGANOPHOSPHORUS INSECTICIDES. Reprint: Ceylon J. Sci. (Bio. Sci.), 11(1): 53-59.

18805. Nomura, Minoru, Kiyoshi Sakai, and Fumio Takashima (Tokyo Univ. of Fish., Konan-4, Minato-ku, Tokyo, Japan). 1974. THE OVER-RIPENING PHENOMENON OF RAINBOW TROUT - I. TEMPORAL MORPHOLOGICAL CHANGES OF EGGS RETAINED IN THE BODY CAVITY AFTER OVULATION. Bull. Jap. Soc. Sci. Fish., 40(10): 977-984. In Japanese with figures and plates in English.

It has been frequently observed that during the stripping operation of the female rainbow trout, some eggs known as "over-ripened ova" contain oil globules which form into a lump. Furthermore, the yolk of such egg is characterized by a semi-transparency. It was confirmed from the present study that these eggs are not the products of abnormal ovarian function, but instead characterize a condition caused by an extended in situ existence within the body cavity following ovulation. This process of over-ripening could be divided into four stages according to the following description: normal ova immediately following ovulation (stage I) early stage of over-ripening (stage II), followed by over-ripened ova (stage III), which then transform into the irregularly shaped ova with considerable decrease in their material content (stage IV). The progressive formation of over-ripened eggs, stage II, III and IV eggs could be generally recognized at about the 10th, 30th and 35th day following ovulation, respectively. During this process of over-ripening, partial collapse of the cortical alveoli and formation of a blastoderm-like structure permeated with oil globules occurred. In the course of water-induced activation of eggs, the collapse of the cortical alveoli was restricted and bipolar differentiation was retarded in over-ripened eggs. (Authors)

18806. Bergman, Harold L., Kenneth R. Olson, and Paul O. Fromm (Dept. of Physiol., Mich. State Univ., East Lansing, Michigan). 1974. THE EFFECTS OF VASOACTIVE AGENTS ON THE FUNCTIONAL SURFACE AREA OF ISOLATED-PERFUSED GILLS OF RAINBOW TROUT. J. comp. Physiol., Vol. 94, pp. 267-286.

The relative functional surface area of isolated-perfused gills was evaluated by measuring the influx of ^{14}C-urea, a passively diffusing molecule. The catecholamines, norepinephrine and epinephrine, increase functional gill surface area and decrease overall branchial vascular resistance. Surface area and resistance effects of adrenergic agonists and blocking agents demonstrated the presence of both α and β adrenergic receptors in rainbow trout gills. Stimulation of α adrenergic receptors increased both functional surface area and branchial vascular resistance, while β adrenergic receptor stimulation increased functional surface area but decreased branchial vascular resistance. Acetylcholine decreased functional gill surface area and increased overall branchial vascular resistance. The data presented strongly indicate that the functional surface area of rainbow trout gills can be regulated by changing perfusion pathway with adjustments in the relative vascular resistance across the different pathways. (Authors' summ.)

18807. Hildebrand, S. G. (Environ. Sciences Div., Oak Ridge Natl. Lab., P. O. Box X, Oak Ridge, Tennessee 37830). 1974. THE RELATION OF DRIFT TO BENTHOS DENSITY AND FOOD LEVEL IN AN ARTIFICIAL STREAM. Limnol. Oceanogr., 19(6): 951-957.

The relationship between drift rates, benthos density, and food level for select taxa of stream invertebrates was studied in an artificial stream system to determine if drift is independent of or dependent on population density, and if food level affects drift rates. Two taxa were introduced in a range of densities at a single level of periphyton food, and the drift from each density was measured. Four taxa were introduced in a range of densities at low and high food levels, and the drift from each density at each food level was measured. The drift of all taxa, examined by simple linear regression analysis, at each food level was judged a density independent response to increasing population density. The drift of three taxa at a given density was significantly greater at the lower food level: it is suggested that increased activity in searching for food at the lower food level resulted in increased drift. (Auth.)

18808. Halver, J. E. (Western Fish Nutr. Lab., Cook, Washington 98605). 1975. NUTRITIONAL REQUIREMENTS OF COLD WATER FISH. Proc. 9th int. Congr. Nutr., Mexico 1972, Vol. 3, pp. 142-157 (Karger, Basel 1975).

18809. Stauffer, Jay R., Jr., Kenneth L. Dickson, and John Cairns, Jr. (Biol. Dept. and Center for Environ. Studies, Virginia Polytechn. Inst. and State Univ., Blacksburg, Virginia 24061). 1974. A FIELD EVALUATION OF THE EFFECTS OF HEATED DISCHARGES ON FISH DISTRIBUTION. Water Resources Bulletin, 10(5): 860-876.

Studies were conducted to determine the distribution of fish in the New and East Rivers in relation to thermal discharges from Appalachian Power Company's fossil fuel plant at Glen Lyn, Virginia. Over 15,300 specimens representing 41 species were collected with seines, electrogear and rotenone at six sampling locations from February, 1973 to October, 1973. Sampling frequency was designed to evaluate the effects of ambient temperature upon preferred temperature. Diversity indices were calculated for each location. There was a slight decrease in the diversity indices for those stations located in the thermal discharge. Condition coefficients calculated for Notropis albeolus Jordan, Notropis rubellus Aqassiz, Notropis spilopterus Cope, Ictalurus punctatus Rafinesque, and Etheostoma blennioides Rafinesque were found to be significantly ($p = .05$) lower in the thermal discharge for all species tested except E. blennioides. Temperatures were plotted against frequency of capture to determine a particular species temperature selection from field data and indicated that: (1) Some species avoided high temperatures (i.e., Campostoma anomalum Rafinesque). (2) Some species were attracted to high temperatures (i.e., Ictalurus punctatus). (3) Some species distribution was not affected by temperatures (i.e., Notropis spilopterus). (Authors)

18810. Jenkins, Robert M. (Natl. Reservoir Research Prog., U. S. Fish and Wildl. Serv., Fayetteville, Arkansas). 1974. RESERVOIR MANAGEMENT PROGNOSIS: MIGRAINES OR MIRACLES. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 374-385.

There are about 500 reservoirs (larger than 500 acres), totalling 4.3 million acres, in the 14 states of the Southern Division. Angling demand is predicted to double on Southern waters by the year 2000, and most of the increase is expected to be satisfied by man-made lakes. Southern reservoirs are typically below average in basic fertility, but long growing seasons foster high annual production rates, resulting in above average sport fish yield potentials. The steady accumulation of reservoir environmental and biological data during the past quarter century has greatly increased our ability to predict standing crops and angler harvests and to devise management practices based on production potentials. Production is primarily controlled by available nutrients, basin morphometry, water exchange rate, climatic cycles, eutrophication rate, and species composition. Future management plans for individual reservoirs should be based on detailed models of environmental factors and calculated optimum production and yield levels. Manipulation of controllable environmental factors (e.g., water level fluctuation, water exchange rate), intensive cultivation of exposed lake bottoms in the fluctuation zone to enhance survival and growth of sport fish young, and improvement of the forage base through introductions of threadfin shad and other species should receive increased management emphasis. The increasingly successful practice of stocking striped bass, walleye, and other predators should be thoroughly evaluated in terms of angler harvest and effects on existing fish populations. The prognosis for reservoir management is good. (Auth.)

18811. Stambaugh, John W., Jr., and Robert F. Denoncourt (York Coll. of Pennsylvania, York, Pa. 17405). 1974. A PRELIMINARY REPORT ON THE CONEWAGO CREEK FAUNAL SURVEY, LANCASTER COUNTY, PENNSYLVANIA. Proc. Pa. Acad. Sci., Vol. 48, pp. 55-60.

Base line data is increasingly necessary to determine the extent of man's impact on the environment. Data relative to fishes, macroinvertebrates and selected physical parameters from a total of 30 collections taken from July 1972 to November 1973 at four stations in Conewago Creek, Dauphin/Lancaster County are presented. An annotated list of fishes is included. Macroinvertebrates and species diversity indices for fishes and macroinvertebrates are discussed. (Authors)

18812. May, Robert C. (Hawaii Inst. of Mar. Biol., P. O. Box 1346, Kaneohe, Hawaii 96744). 1975. EFFECTS OF TEMPERATURE AND SALINITY ON FERTILIZATION, EMBRYONIC DEVELOPMENT, AND HATCHING IN Bairdiella icistia (PISCES: SCIAENIDAE), AND THE EFFECT OF PARENTAL SALINITY ACCLIMATION ON EMBRYONIC AND LARVAL SALINITY TOLERANCE. NOAA Fish. Bull., 73(1): 1-22.

Eggs and larvae of the sciaenid fish bairdiella, Bairdiella icistia, were obtained from fish matured in the laboratory by photoperiod manipulation and induced to spawn by hormone injections. The effects of temperature and salinity on fertilization, embryonic development, hatching, and early larval survival were studied with the material thus obtained, and the effects on gametes of parental salinity acclimation were also investigated. Fertilization took place over a wide range of temperatures and salinities, but was completely blocked at salinities of 10 °/oo and below. A low level of spermatozoan activity may have accounted for the lack of fertilization at low salinities. Successful embryonic development occurred between temperatures of approximately 20° and 30°C, and salinities of 15 and 40 °/oo. The production of viable larvae was estimated to be optimal at a temperature of 24.5°C and a salinity of 26.6 °/oo. An interaction of the two factors was apparent, development at high salinities being most successful at low temperatures and development at high temperatures being most successful at low salinities. The stage of maturity of the spawning female had a great influence on the overall viability of the eggs produced, as well as on their response to temperature and salinity. Adult bairdiella matured sexually in dilute seawater with a salinity of 15 °/oo, and the salinity tolerance of the eggs produced by these fish was unaltered. (Auth.)

18813. Amend, Donald F., and Lynnwood Smith (Western Fish Disease Lab. Naval Support Activity, and Coll. of Fish., Univ. of Wash., Seattle, Washington 98115). 1975. PATHOPHYSIOLOGY OF INFECTIOUS HEMATOPOIETIC NECROSIS VIRUS DISEASE IN RAINBOW TROUT: HEMATOLOGICAL AND BLOOD CHEMICAL CHANGES IN MORIBUND FISH. Infect. Immun., 11(1): 171-179.

Infectious hematopoietic necrosis (IHN) is a rhabdoviral disease of rainbow trout (Salmo gairdneri). Trout were injected with IHNV, and various hematological and biochemical measurements of clinically ill fish were compared to uninfected controls. Infected fish had reduced corpuscular counts, hemoglobin, and packed cell volume, but normal mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration. The percentage of immature erythrocytes was increased, but the percentage of leukocytes was unchanged. Differential leukocyte counts showed a significant decrease in neutrophils, increase in lymphocytes, but no change in monocytes. Unidentifiable necrobiotic cells were prevalent in blood smears and hematopoietic tissue imprints. Plasma bicarbonate, chloride, calcium, phosphorus, bilirubin, and osmolality were significantly reduced, but plasma glucose and anterior kidney ascorbate were unchanged. Plasma pH increased and the alpha fractions of the serum proteins were altered. No change was found in plasma enzymes, except that a LDH isozyme was significantly increased. The alkali reserve was diminished and alterations in acid-base and fluid balance occurred. Death probably resulted from a severe electrolyte and fluid imbalance caused by renal failure. (Authors)

18814. Jones, Albert R. 1973. INVENTORY AND CLASSIFICATION OF STREAMS IN THE KENTUCKY RIVER DRAINAGE. Kentucky Fish. Bull. No. 56, Dept. of Fish and Wildl. Resources, 108 p. + map.

Streams of fishery significance in the Kentucky River drainage were classified as to order. One hundred and fourteen inventory studies were conducted on these streams. Some of the physical, chemical, and biological characteristics of the streams are described as well as the general characteristics of the fishery. The Kentucky River drainage includes approximately 2,018 miles of stream capable of providing a sport fishery. Twenty-one streams were considered to be of outstanding quality while approximately 597 miles (29%) have been degraded by pollution. A grand total of 99 species of fishes representing 18 families were identified from the Kentucky River drainage. The longear sunfish was the most frequently recorded species, occurring in 81% of the samples. The bluntnose minnow was the most abundant species in the combined samples. (Auth.)

18815. Roy, Jean-Marie (Biol. Serv., Fish Mgmt., Min. of Industry and Commerce, Quebec, Canada G1V 4C7). 1973. GROWTH, BEHAVIOR AND FEEDING OF THE SILVER LAMPREY (Ichthyomyzon unicuspis, Hubbs and Trautman) IN CAPTIVITY. [Croissance, Comportement et Alimentation de la Lamproie du Nord (Ichthyomyzon unicuspis, Hubbs & Trautman) en captivite]. Travaux sur les Pecheries du Quebec No. 41, 144 p. In French.

Observations made on 50 lampreys (27 ♂♂ and 23 ♀♀) kept in aquariums from catch to death revealed new particulars concerning growth, in I. unicuspis, besides confirming the previously acquired knowledge on that species. Female lampreys grow faster than males and attain larger maximum length. The reduction in length as the lamprey approaches maturity is slower but more pronounced in females. Lampreys that fed did not shrink as much as those that did not eat. Lampreys grow more rapidly and reach maturity earlier in captivity than in their natural habitat. The younger an individual is placed into an aquarium, the faster it will reach maturity. Out of the 50 specimens used in the experiment, 24 attached themselves to fishes, for an average attachment period equivalent to the third of their stay in the aquariums. Lampreys chose to feed on seven of the 23 fish species presented to them. The percentage of attachments for feed is larger in females. Feeding activity diminishes as lampreys approach adult stage. The average weight of the hosts selected is directly proportional to the average length of the lampreys that attach themselves to them. A little more than half the hosts were killed by lampreys, 87.5% of which were in the growth stage. There is no relation whatsoever between the percentage of hosts killed and their weight or the duration of attachment. One third of wounds resulted in the death of the host, the most adverse factors being the low stage of maturity of lampreys and the location of wounds in most vulnerable regions, such as the head and abdomen. Taking these factors into account, we have noted specific capacities of resistance to the effects of lampreys' predatory action. Of the five main species of hosts represented, A. calva unquestionably proved the most resistant. In the other four species, although the difference is less pronounced, it seems evident that C. commersoni is more resistant than C. catostomus, and I. punctatus is more resistant than I. nebulosus. (Auth.)

18816. Tash, Jerry C., and Jerome B. Keister (Louisiana Coop. Fish. Unit, Louisiana State Univ., Baton Rouge, Louisiana 70803). 1974. LIMNOLOGICAL CHARACTERISTICS OF SOME LAKES IN THE AREA OF BATON ROUGE, LOUISIANA. Louisiana Academy of Sciences, Vol. 37, pp. 32-36.

A limnological study conducted on seven impoundments in the Baton Rouge area included determination of dissolved oxygen, temperature, pH, nitrate, orthophosphate and transparency in selected areas, in conjunction with the collection of samples for analyses of benthos, zooplankton and C^{14}. Although impoundments are eutrophic, primary and secondary productivity are low, probably due to high turbidity. (Authors)

18817. Schulte, Thomas L., and Robert T. Lackey (Dept. of Fish. & Wildl. Sci., Virginia Polytechn. Inst. and State Univ., Blacksburg, Virginia 24061). 1974. EFFECT OF RATE OF WATER DISCHARGE ON PHYTOPLANKTON IN CLAYTOR LAKE, VIRGINIA. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 402-414.

Claytor Lake, Virginia, an 1820 ha main stem hydroelectric reservoir, was studied for one year to determine the effect of water discharge on reservoir phytoplankton. Number/liter, areal units/liter, average cell size, and chlorophyll a content were used as measures of phytoplankton abundance. Rate of water discharge had an adverse effect on reservoir phytoplankton during spring and summer. Although increased rate of water discharge caused increased phytoplankton loss, the adverse effect of rate of water discharge on reservoir phytoplankton populations was probably at least partially due to additional discharge of nutrients. The inverse relationship between rate of water discharge and reservoir phytoplankton populations decreased in the uplake direction. (Authors)

18818. Imler, Richard L. 1974. FLUORESCENT PIGMENT MARKING TECHNIQUES. Colo. Dept. of Nat. Resources, Fishery Information Leaflet No. 28, 2 p.

18819. Laing, R. L. (Clean-Flo Labs., Inc., Hopkins, Minnesota). 1974. A NON-TOXIC LAKE MANAGEMENT PROGRAM. Hyacinth Control Journal, Vol. 12, pp. 41-43; Selected Water Resources Abstracts, 8(2): p. 58.

An aeration system and its mode of operation, based on aeration requirements, depth of bottom muck or peat, and bottom topography, are described. The total concept of the aerator is to move as much water from the bottom to the surface as economically as possible, and then let the wind oxygenate the water and allow diffusion of unwanted gasses to the atmosphere. About 3,000 gpm was observed rising to the surface from a diffuser at 6 ft deep with a 0.33 hp compressor. The same unit produced at 12,000 pgm at 12 ft depth. When carbon dioxide reaches approximately 5 ppm and pH is over 8.0, the phosphate precipitant may be added. Precipitant level is determined approximately by organic muck, manganese, iron and total phosphorus remaining after carbon dioxide has reached a minimum level. A soluble non-toxic calcium-based product was tested in 25 Minnesota lakes and 8 in Florida. Generally, 5 to 30 ppm was added and phosphate removal ranged from 70 to 100%. After using the aerator and subsequent application of Clean-Flow Lake Cleanser, all signs of muck was gone in two weeks, revealing a clean sandy bottom in a trout fishery pond.

18820. Boyce, Norbert P. J. (Dept. of the Environ., Fish. and Mar. Service, Pacific Biol. Sta., Nanaimo, British Columbia V9R 5K6, Canada). 1974. BIOLOGY OF Eubothrium salvelini (CESTODA: PSEUDOPHYLLIDEA), A PARASITE OF JUVENILE SOCKEYE SALMON (Oncorhynchus nerka) OF BABINE LAKE, BRITISH COLUMBIA. J. Fish. Res. Board Can., 31(11): 1735-1742.

Adult worms recovered from naturally infected sockeye salmon (Oncorhynchus nerka) smolts provided the eggs for regeneration of Eubothrium salvelini in the laboratory. Of several copepods tested three species of Cyclops proved to be successful intermediate hosts whereby infections were ultimately transmitted to sockeye fry. The parasite's life cycle is described. The rate of development within the intermediate host is shown to be related directly to temperature. It is also demonstrated that susceptibility of fry to infection diminishes as they exceed a certain size. (Auth.)

18821. Singley, John A., and Walter Chavin (Dept. of Biol., Wayne State Univ., Detroit, Michigan 48202). 1975. SERUM CORTISOL IN NORMAL GOLDFISH (Carassius auratus L.). Comp. Biochem. Physiol., 50(1A): 77-82.

Differences are not present in serum cortisol titers of goldfish after rapid capture with a net, ice immobilization, MS 222 anesthesia or electric immobilization. Expression of serum cortisol titer without reference to animal weight (μg/100 ml) reveals that statistically significant differences in this parameter are present in the goldfish of the weight range studied (1.9-19.9 g). However, when serum cortisol titers are expressed as a function of animal weight, fish in the weight range 5.0-12.9 g are not significantly different. The cortisol circadian rhythm determined for goldfish consists of two periods of high cortisol levels (1200 and 1600 hours). Two periods of low cortisol titer are present, one period being of short duration and the second period being extended. The average circulating cortisol levels in goldfish are 4.9 ± 0.9 μg/100 ml per g at the peak periods and 2.6 ± 0.4 μg/100 ml per g at the low periods. (Authors)

18822. Mehrle, Paul M., W. Waynon Johnson, and Foster L. Mayer, Jr. (Fish-Pesticide Res. Lab., U. S. Dept. of the Interior, Route 1, Columbia, Missouri 65201). 1974. NUTRITIONAL EFFECTS ON CHLORDANE TOXICITY IN RAINBOW TROUT. Bull. Environ. Contamin. Toxicol., 12(5): 513-517.

Rainbow trout were fed the commercial diets Oregon Moist, Glencoe, Silver Cup, or Ewos, and synthetic diets containing 23% or 45% protein. After feeding the diets for 42 days, chlordane was tested against rainbow trout in static toxicity tests. LC50s (96-hr) for chlordane were 8.2, 9.1, 20, 31, 29 and 47 μg/l for the groups fed Oregon Moist, Glencoe, Silver Cup, Ewos diets and synthetic diets that contained 23 and 45% protein, respectively. The LC50 for the group fed the 45% protein diet was statistically ($P=0.05$) different from the values for all the other groups. Also, the values differed among groups fed commercial diets. (Authors' summ.)

18823. Barwick, D. Hugh (Fla. Game and Freshwater Fish Comm., Eustis, Fla. 32726). 1974. THE EFFECT OF INCREASED SODIUM CHLORIDE ON STRIPED BASS FRY SURVIVAL IN FRESHWATER PONDS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 415-419.

An investigation of the effects of increased sodium chloride concentrations on striped bass fry survival was conducted at the Auburn University Fisheries Research Unit from April 8 to July 7, 1972. The mean survival of fry in ponds with increased sodium chloride concentrations was 7.65% as opposed to 1.70% in six control ponds. The survival in all ponds was highly variable, ranging from 0.33 to 39.50% in increased sodium chloride ponds and from 0.00 to 9.58% in control ponds. (Auth.)

18824. Hunt, Robert L. 1974. ANNUAL PRODUCTION BY BROOK TROUT IN LAWRENCE CREEK DURING ELEVEN SUCCESSIVE YEARS. Tech. Bull. No. 82, Dept. of Natural Resources, Box 450, Madison, Wis. 53701, 29 p.

Annual production by the wild brook trout (Salvelinus fontinalis) population in Lawrence Creek, Wisconsin was estimated for 11 consecutive years (1960-70). Production annually by all age groups combined varied only 20 percent (436-526 kg) and averaged 478 kg (11.7 g/m^2). Much greater annual variations in annual production occurred within each of the age groups (119 percent range for age 0, 97 percent for age I, and 700 percent for age II) and in all four of the study sections (95 percent in Section A, 44 percent in Section B, 69 percent in Section C, and 176 percent in Section D). Annual production was not dependent on the biomass of the population in April, when the 6-month period of most rapid growth began, but efficiency of annual production (P:B ratios) was significantly correlated with April biomass (r-0.943**). Production was homeostatically regulated through compensatory adjustments in growth rates and survival rates of varying regulatory importance among age groups. Within study sections, annual production was highest in Section A, the most upstream section, where it averaged 18.8 g/m^2, exceeded 20 g/m^2 during the last 4 years and reached a peak of 25.8 g/m^2 in 1969. High production in this section was attributed to physical alterations in the trout habitat resulting from a management program of "stream improvement" carried out in 1964 to increase pool area and streambank hiding cover for trout. Despite the upward trend in production in developed Section A, streamwide production remained quite stable because of concurrent downward trends in production in Sections C & D. Comparison of annual production trends in improved Section A to annual production trends in the three unimproved sections revealed a high degree of intersectional dependence not previously realized from numerous analyses of standing stock data. A simplistic production model was developed to tie together some of the compensatory adjustments in growth and survival among age groups 0-III that acted in synchrony each year to maintain production at a consistent level for the population as a whole. This study of annual production and identification of some of the processes that regulate it provided insights into the dynamics of this brook trout population that no other population parameter provided. Such insights can be valuable additions to the storehouse of information that is needed to more effectively manage fish populations, whether that management is directed at optimizing production of fish for human consumption or improving the quality of sport fishing. (Auth.)

18825. Pillai, Appu K., and Charles Terner (Dept. of Biol., Biol. Sci. Center, Boston Univ., Boston, Massachusetts 02215). 1974. STUDIES OF METABOLISM IN EMBRYONIC DEVELOPMENT. VI. CORTISOL-BINDING PROTEINS OF TROUT EMBRYOS. Gen. Comp. Endocrinol., 24(2): 162-167.

A stable and an unstable cortisol-protein binding complex were isolated from the cytosol of rainbow trout embryos. The binding protein of the major stable complex had a molecular weight of 50,000; the protein had high specificity for cortisol; the association constant K of the binding complex was 2×10^{11} M^{-1}. The binding complex isolated from the nuclear fraction of the embryos had the same sedimentation velocity in a sucrose gradient as the major binding component of the cytosol. The minor unstable component was present in both the cytosol of the embryos and in the blood plasma of the adult trout. (Authors)

18826. Rafail, Samir Zaky (Inst. of Oceanogr. and Fisheries, Kayed Bey, Alexandria, Arab Republic of Egypt). 1974. STUDY OF FISH POPULATIONS BY CAPTURE DATA AND THE VALUE OF TAGGING EXPERIMENTS. FAO Studies and Reviews. General Fisheries Council for the Mediterranean, pp. 1-27.

The study of some parameters of fish populations such as catchability, fishing mortality, natural mortality, abundance and recruitment is discussed in this document. A number of successive sampling surveys are carried out with no intervening time. The sampling surveys are grouped so that population parameters may remain constant within groups of sampling surveys and vary between them. Each group of surveys must contain three or more surveys and may represent a season, i.e. population parameters are assumed to remain constant within seasons and vary from one season to another. A population may be subdivided according to certain characters into a number of sub-populations with different parameters which may be studied separately. The catchability may be estimated from numbers of captured fish and fishing effort as shown by Eqs. (5.1) to (5.4) allowing the evaluation of fishing mortalities "F". Abundance estimates may be obtained as shown by Eq. (4.5) and used to evaluate instantaneous abundance coefficient "A by Eq. (6.1). The sum of fishing mortality and instantaneous abundance coefficient is used as an estimate of the difference between the instantaneous recruitment "R" and natural mortality "M". Natural mortality may be estimated directly during seasons with zero recruitment as F + A = R - M = zero - M = - M. The estimation of natural mortality allows the evaluation of recruitment rate. Tagged fish are used to represent a group of fish, the abundance of which is not affected by recruitment and immigration so long as no more tagged fish are added after the start of sampling surveys. It is suggested that natural and extra-tagging mortalities may be estimated by liberating two or more groups of tagged fish with one, two or more tags attached to each fish to find a relation between number of tags and mortality by causes other than fishing, which becomes equal to natural mortality when the number of tags attached to a fish is reduced to zero. The estimates are free from types A and B tagging errors. Tagging experiments help the estimation of parameters unbiased by unexpected recruitments and fish migrations. (Auth.'s summ.)

18827. Calabrese, Anthony, Ries S. Collier, and James E. Miller (Milford Lab., Middle Atlantic Coastal Fish. Center, NMFS, NOAA, Milford, Connecticut 06460). 1974. PHYSIOLOGICAL RESPONSE OF THE CUNNER, Tautogolabrus adspersus, TO CADMIUM. I. INTRODUCTION AND EXPERIMENTAL DESIGN. NOAA Tech. Report NMFS SSRF-681, 33 p., illus.

The cunner, Tautogolabrus adspersus, was exposed to six concentrations of cadmium, as cadmium chloride ($CdCl_2 \cdot 2\text{-}1/2\,H_2O$), for 96 hr. At the end of this exposure period, tests of blood serum osmolality and gill tissue oxygen consumption were performed. High levels (48 ppm) of this metal resulted in abnormally high serum osmolality, and an exposure as low as 3 ppm reduced the normal rate of oxygen consumption. Both of these parameters may be related to observed tissue damage. The histopathological effects of acute exposure of the cunner to cadmium were manifested in the kidney, intestine, hemopoietic tissue, epidermis, and gill. Few significant changes were noted in fish exposed to concentrations less than 48 ppm. The results implicate renal failure as the probable cause of death subsequent to acute exposure to cadmium. Clearance of intracardially injected bacteria from the blood of cunners exposed to 12 ppm cadmium was examined. The rate of bacterial uptake in the cells of the liver and spleen was increased, but the bacterial death rate within these cells was decreased. Exposure of fish at 3 to 24 ppm failed to influence antibody production against sheep red blood cells. The activity of two liver enzymes changed significantly with exposure to cadmium. Aspartate aminotransferase was lower in the exposed fish, and a magnesium-linked oxidoreductase in exposed fish required 10 times as much added magnesium to reach the same level of activity as in the control fish. Chemical analyses were made for uptake and clearance of cadmium from exposed cunners. In the uptake study, cadmium residues averaged 8.5 times higher in liver than in gills. In the clearance study, substantial reductions in cadmium residues were found in the gills and blood of fish held in clean seawater for 6 wk after exposure to cadmium, as compared to fish sacrificed immediately after exposure. Muscle and carcass samples from the "cleared" fish showed little reductions in cadmium levels. (Authors' summ. abstract)

18828. Hoehn, R. C., J. R. Stauffer, Michael T. Masnik, and C. H. Hocutt (Dept. of Civil Engineering, Center for Environ. Studies, Va. Polytechn. Inst. and State Univ., Blacksburg, Virginia 24061). 1974. RELATIONSHIPS BETWEEN SEDIMENT OIL CONCENTRATIONS AND THE MACROINVERTEBRATES PRESENT IN A SMALL STREAM FOLLOWING AN OIL SPILL. Environmental Letters, 7(4): 345-352.

A study was conducted to assess the effects of an oil spill on the macroinvertebrate populations in a small creek in Virginia. Sediments were extracted with hexane, and the residue concentrations were correlated with the numbers and diversities of macroinvertebrates collected downstream of the spill. Based on the available data, it was concluded that the effect of the oil spill was a toxic one rather than one of rendering the sediments unsuitable for colonization. (Authors)

18829. Mayer, Foster L., Jr., and Herman O. Sanders (Fish-Pesticide Res. Lab., U. S. Fish & Wildl. Serv., U. S. Dept. of the Interior, Columbia, Missouri 65201). 1973. TOXICOLOGY OF PHTHALIC ACID ESTERS IN AQUATIC ORGANISMS. Reprint: Environmental Health Perspectives, Jan. 1973, pp. 153-157.

The low degree of toxicity and the high excretion rate of di-n-butyl and di-2-ethylhexyl phthalates might suggest that these compounds would be relatively safe as far as aquatic organisms are concerned. However, the present data indicate that these compounds can be detrimental to the reproduction of aquatic organisms at low chronic concentrations. The concentrations of phthalic acid esters presently found in waters of the United States are, in some cases, detrimental to aquatic invertebrates in view of laboratory results. Phthalic acid esters are produced in large amounts, they are in wide use as plasticizers, and they are entering aquatic ecosystems. Thus, these compounds should be considered as environmental pollutants, and a more detailed evaluation of toxicological effects of phthalic acid esters is needed to elucidate their impact on aquatic ecosystems. Also, more research is warranted in developing and/or reducing the potential for these compounds to enter aquatic environments. (Authors' summ.)

18830. Hansen, David J., Steven C. Schimmel, and Jerrold Forester (U. S. Environ. Protection Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, Florida 32561). 1974. AROCLOR 1254 IN EGGS OF SHEEPSHEAD MINNOWS: EFFECT ON FERTILIZATION SUCCESS AND SURVIVAL OF EMBRYOS AND FRY. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 420-426.

The effect of the polychlorinated biphenyl (PCB), Aroclor 1254, in eggs of the sheepshead minnow, Cyprinodon variegatus, on fertilization success and survival of embryos and fry was investigated. Adult fish were exposed for four weeks to 0.1, 0.32, 1.0, 3.2 or 10.0 μg/l of PCB, then injected twice with 50 IU of human chorionic gonadotrophin to stimulate egg production. The eggs were fertilized, placed in PCB-free flowing seawater and observed for mortality. Fertilization success was unimpaired by concentrations in eggs as high as 201 μg/g but survival of embryos and fry was reduced. Usually, fry from eggs containing 7.0 μg/g or more began dying 24-48 hours after hatching. If this PCB affects other species similarly, then populations of fish that presently have comparable concentrations in their eggs may be endangered. (Authors)

18831. Clark, A. S., and J. C. H. Carter (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1974. POPULATION DYNAMICS OF CLADOCERANS IN SUNFISH LAKE, ONTARIO. Can. J. Zool., 52(10): 1235-1242.

Investigation of populations of Daphnia rosea, D. retrocurva, and Diaphanosoma leuchtenbergianum in Sunfish Lake, southern Ontario, during 1969 indicated that, in the absence of predation, food supply was the major factor controlling population size and influencing population parameters. Generally with each species, a population peak was preceded by a rise in fecundity, an increase in birth rate, and a fall in death rate. As the carrying capacity of the environment in terms of food was surpassed the population numbers declined, fecundity dropped off, and the death rate rose. A strong negative correlation between fecundity and death rate was observed. (Authors)

18832. Chew, Robert L. 1974. EARLY LIFE HISTORY OF THE FLORIDA LARGEMOUTH BASS. Fishery Bull. No. 7, Florida Game & Fresh Water Fish Comm., Tallahassee, Florida 32304, 76 p., illus.

The early life history of the Florida largemouth bass, Micropterus salmoides floridanus (LeSueur) was investigated in two environmentally different lakes over a 3-year period. The primary study lake (Lake Weir) was less eutrophic, larger, deeper, cooler, and had a well balanced fish population. Lake Hollingsworth, conversely, was highly eutrophic, smaller, warmer, shallow and had little or no largemouth bass reproduction from 1965 through 1968. The zooplankton community in both lakes consisted of copepods and cladocerans and fluctuated considerably over the sample period. Lake Hollingsworth supported more copepods ($\overline{X}$ = 3706/M^3) than Lake Weir ($\overline{X}$ = 1337/M^3) while the cladoceran population of Lake Weir ($\overline{X}$ = 882/M^3) was considerably higher than in Lake Hollingsworth ($\overline{X}$ = 154/M^3). There appeared to be an abundant invertebrate food supply available to larval and juvenile largemouth bass in both lakes, and food supply was not the factor limiting reproduction in Lake Hollingsworth. Both the character index (138) and the average number of pyloric caeca ($\overline{X}$ = 33.8) established largemouth bass in Lake Weir as the subspecies M. s. floridanus. Largemouth bass in Lake Hollingsworth had a similar number of pyloric caeca ($\overline{X}$ = 32.2). The initial bass spawn in Lake Weir in 1968 occurred during the first week in February (water temperature, 59°F) and in 1969 in the latter part of January (water temperature, 60°F). Peak spawning activity occurred during March and in generally colder water temperatures (60 to 65°F) than reported in the literature. Nest construction, spawning behavior and egg deposition was observed and is described. Eggs were artificially fertilized in the laboratory and observed and photographed through time. Embryonic development, hatching and larval development is described. The use of occupied largemouth bass nests by the golden shiner, Notemigonus crysoleucas, and by the taillight shiner, Notropis maculatus is described. Growth in Lake Weir was slower than previously reported in Florida waters. Growth of the 3-year classes followed in Lake Weir (1968, 1969 and 1970) was quite similar. Most rapid growth is indicated in the late summer and fall and is undoubtedly related to both temperature and feeding habits. At approximately age 1, Lake Weir juveniles averaged 147 mm (1968 year-class) and 148 mm (1969 year-class) and at age 2, the 1968 year-class averaged approximately 240 mm. Growth in Lake Hollingsworth was significantly faster and compares with previously reported growth in Florida waters. Growth for the two year-classes (1969 and 1970) produced in Lake Hollingsworth was similar. Fast and slow growth periods compare to those determined in Lake Weir. At one year of age, Lake Hollingsworth juveniles had attained an average fork length of approximately 188 mm. By the time of the last sample, September 6, 1970, some of the faster growing age 1+ Lake Hollingsworth juveniles had surpassed the size of age 2+ Lake Weir juveniles and the average fork length of 1969, age 1+, Hollingsworth juveniles ($\overline{X}$ = 249 mm) was nearing that for 1968, age 2+ Lake Weir juveniles ($\overline{X}$ = 274 mm). Condition factors increased with age or size of fish and varied seasonally. Higher "K" factors were obtained in the summer months and lower values occurred during winter. Lake Weir juveniles had lower "K" values than juveniles obtained in other lakes. At age 3 months, Lake Weir juveniles of the 1969 and 1970 year-classes had similar "K" values and averaged 2.140. At age 1 year 3 months, the values were also not different and averaged 2.294 and at age 2 years 3 months, "K" for the 1968 year-class averaged 2.459. Condition factors for Lake Hollingsworth juveniles were considerably higher than those found in Lake Weir. At age 3 months, Lake Hollingsworth juveniles averaged 2.304 (1969 year-class) and 2.651 (1970 year-class). Juveniles at 1 year 3 months averaged 2.386. The length-weight relationships of juvenile largemouth bass from Lakes Weir and Hollingsworth were quite similar and comparable to those reported in the literature. There were differences in the diet of three size groups of juvenile Florida largemouth bass (13 to 30 mm, 31 to 75 mm, and 76 to 307 mm fork length) in both lakes. The smaller size group fed almost exclusively on zooplankters (predominantly cladocerans) and fed most frequently with 96% in both lakes containing food. The next size group (31 to 75 mm) fed predominantly on small insects in Lake Weir and on insects and small fishes in Lake Hollingsworth. In Lake Weir, 90.36% of the 31-75 mm size group contained food, while in Lake Hollingsworth the value was lower (73.91%). Specimens larger than 75 mm fed on fishes and decapods in

Lake Weir and almost entirely on fishes in Lake Hollingsworth. In Lake Weir, 74.37% of the larger juveniles contained food, while only 56.00% of the larger Lake Hollingsworth juveniles had eaten. Food of Lake Hollingsworth juvenile largemouth bass was less diverse than in Lake Weir and shifted from zooplankton to insects to fish at a smaller size. The predominance of cladocerans in the stomachs of small juvenile bass indicates some degree of selectivity or availability over the more abundant copepods. Sex ratios in samples of Lake Weir largemouth bass (200-300 mm F.L.) were generally of a 1-to-1 ratio. The male ratio significantly increased in the 300-374 mm F.L. size group (1.80 to 1) and indicated that male growth slowed at this point while the females continued to grow. Females outnumbered males 1 to .31 in the 375-475 mm size group and above 475 mm F.L., there were only females. Fishing citations awarded in Florida suggest that Florida largemouth bass are frequently captured weighing up to 15 pounds and have been caught up to 19 pounds. It has been recently shown that this large potential size is inherent in the subspecies and not due only to Florida's climate. (Auth.'s summ.)

18833. Raney, E. C., B. W. Menzel, and E. C. Weller (Ichthyological Associates, Inc., Ithaca, New York). 1973. HEATED EFFLUENTS AND EFFECTS ON AQUATIC LIFE WITH EMPHASIS ON FISHES. A BIBLIOGRAPHY. Available from NTIS, Springfield, Va. 22161 as TID-3918, $13.60 paper copy, $2.25 microfiche. Bulletin No. 9, 651 p.; Selected Water Resources Abstracts, 8(4): p. 49.

This bibliography regarding heated effluents and effects on aquatic life with emphasis on fishes is the fourth in the series. The report was composed and/or indexed by computer programs forming a part of the Oak Ridge Computerized Hierarchical Information System (ORCHIS). Four thousand and ninety-nine references are listed. The bibliography also includes a permutated title index and author index.

18834. Parrish, Patrick R., John A. Couch, Jerold Forester, James M. Patrick, Jr., and Gary H. Cook (U.S. Environ. Protection Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, Florida 32561). 1974. DIELDRIN: EFFECTS ON SEVERAL ESTUARINE ORGANISMS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 427-434.

Tests were conducted to determine (1) the acute toxicity of dieldrin in flowing sea water to American oysters (Crassostrea virginica), pink shrimp (Penaeus duorarum), grass shrimp (Palaemonetes pugio) and sheepshead minnows (Cyprinodon variegatus) and (2) the rate of dieldrin uptake and depuration by spot (Leiostomus xanthurus). Acute (96-hour) EC50's were: oysters, 12.5 μg/l; pink shrimp, 0.9 μg/l; grass shrimp, 11.4 μg/l; and sheepshead minnows, 23.6 μg/l. Spot exposed to 0.0135, 0.075, 0.135, 0.75 or 1.35 μg/l for 35 days accumulated the chemical with maximum concentrations attained in 11 to 18 days. Maximum whole-body residue (wet-weight) was 6,000X the concentration in test water. Spot contained no detectable dieldrin residues at the end of a 13-day depuration period in dieldrin-free water. Tissue alterations, such as subepithelial edema in gill lamellae and severe lysis and sloughing of the small intestine epithelium, occurred in spot exposed to 1.35 μg/l for four days. (Authors)

18835. Sinley, James R., John P. Goettl, Jr., and Patrick H. Davies (Colorado Div. of Wildl., Ft. Collins, Colorado 80521). 1974. THE EFFECTS OF ZINC ON RAINBOW TROUT (Salmo gairdneri) IN HARD AND SOFT WATER. Bull. Environ. Contamin. Toxicol., 12(2): 8 p., reprint.

The toxicity of zinc to rainbow trout (Salmo gairdneri Richardson) was determined in hard (330 mg/liter) and soft (25 mg/liter) water. A chronic bioassay in hard water resulted in an MATC range of 640 to 320 μg/liter zinc. A chronic bioassay in soft water resulted in an MATC range of 260 to 140 μg/liter zinc. Acute bioassays with juvenile fish in hard and soft water resulted in TL_{50} values of 7210 and 430 μg/liter zinc, respectively. An acute bioassay with eyed eggs in soft water resulted in a TL_{50} value of 2720 μg/liter zinc. Rainbow trout are more resistant to zinc if they are exposed as eyed eggs. (Authors)

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18836. Paterson, W. D., and J. L. Fryer (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon 97331). 1974. EFFECT OF TEMPERATURE AND ANTIGEN DOSE ON THE ANTIBODY RESPONSE OF JUVENILE COHO SALMON (Oncorhynchus kisutch) TO Aeromonas salmonicida ENDOTOXIN. J. Fish. Res. Board Can., 31(11): 1743-1749.

Specific antibody production in response to an intraperitoneal injection of A. salmonicida endotoxin first occurred in juvenile coho salmon (Oncorhynchus kisutch) held at 6.7, 12.2, and 17.8 C at 4, 2 and 1 wk, respectively. Aeromonas salmonicida endotoxin was antigenic to juvenile coho salmon at all doses between 1 and 5000 μg administered intraperitoneally with and without an aluminum hydroxide carrier. The endotoxin was nontoxic to juvenile coho salmon when 1-5000 μg was injected intraperitoneally and the fish held at temperatures from 6.7 to 17.8 C or when "free endotoxin" was administered by the intramuscular or intraperitoneal route. Aeromonas salmonicida endotoxin was toxic to mice, however. (Authors)

18837. Carr, William E. S., and James T. Giesel (C. V. Whitney Mar. Lab. of Univ. of Florida at Marineland, Route 1, Box 121, St. Augustine, Florida 32084). 1975. IMPACT OF THERMAL EFFLUENT FROM A STEAM-ELECTRIC STATION ON A MARSHLAND NURSERY AREA DURING THE HOT SEASON. NOAA Fishery Bulletin, 73(1): 67-80.

Seine samples of fishes were collected during the hot season from three similar marshland creeks situated at various distances from a steam-electric station near Jacksonville, Fla. Thermal effluent from the electric station is discharged directly into one creek and enters a second creek on the initial stage of each rising tide. The third creek remained at ambient temperature. Fishes collected in the samples were analyzed for species composition and for density and biomass per unit area. A total of 48 species belonging to 23 families were identified. Thirty-seven species were collected at least once in the ambient temperature creek whereas 30 species were collected in the creek receiving the maximum amount of thermal effluent. Twenty species appearing in the samples are categorized as utilizable species because they are used by man either as food or for various fishery products. Specimens of all utilizable species were juveniles. In the thermally affected creeks, both the numbers and the biomass per unit area of juveniles of utilizable species were 3- to 10-fold smaller than those obtained in collections from the ambient temperature creek. When data for the entire hot season are considered, the creek receiving the largest input of thermal effluent supported a population of fishes having approximately 19% of its numbers and 32% of its biomass composed of juveniles of utilizable species. In contrast, the ambient temperature creek supported a population having approximately 73% of its numbers and 83% of its biomass composed of such species. Whereas juveniles of two species of mullet (Mugil curema and M. cephalus) accounted for the majority of the utilizable fishes using the thermally affected creeks as a nursery area, large numbers of juveniles of at least five additional utilizable species occupied the ambient temperature creek. These species were as follows (in order of decreasing abundance): tidewater silverside, Menidia beryllina; spot, Leiostomus xanthurus; Atlantic menhaden, Brevoortia tyrannus; silver perch, Bairdiella chrysura; and Atlantic thread herring, Opisthonema oglinum. (Authors)

18838. Post, George, Dean V. Power, and Thomas M. Kloppel (Dept. of Fish. and Wildl. Biol., Colorado State Univ., Ft. Collins, Colorado 80521). 1974. SURVIVAL OF RAINBOW TROUT EGGS AFTER RECEIVING PHYSICAL SHOCKS OF KNOWN MAGNITUDE. Trans. Amer. Fish. Soc., 103(4): 711-716.

Salmonid eggs are known to be sensitive to physical shock at certain stages of development. Survivability of the eggs is unknown when incubating under natural conditions and subjected to the seismic shock of underground nuclear detonations. Rainbow trout eggs were incubated to various stages of development (37.5, 75, 125 or 250 Temperature Units) in simulated redds and subjected to five sequential physical shocks of either 1, 2, 5 or 10 g. Eggs were then allowed to continue incubation to hatch or near hatch. Results indicated no significant difference in survival of eggs subjected to physical shocks of these four magnitudes at the various developmental stages when compared to eggs subjected to no shock. There was no significant difference in egg survival after shocking at 8.2 C (47F) or at 11.1C (52F). (Authors)

18839. Paterson, W. D., and J. L. Fryer (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon 97331). 1974. IMMUNE RESPONSE OF JUVENILE COHO SALMON (Oncorhynchus kisutch) TO Aeromonas salmonicida CELLS ADMINISTERED INTRAPERITONEALLY IN FREUND'S COMPLETE ADJUVANT. J. Fish. Res. Board Can., 31(11): 1751-1755.

The antibody response of a population of juvenile coho salmon (Oncorhynchus kisutch) held at 12 C approached 100% following a single parenteral vaccination with Aeromonas salmonicida cells emulsified in Freund's complete adjuvant. This response indicates that coho salmon behave as a homogeneous population with respect to immunological competence. Fish as small as 1.2 g produced antibodies as early as 4 wk after administration of this vaccine; high levels of antibody persisted for at least 1 yr after injection. This single vaccination provided juvenile coho salmon with protective immunity against furunculosis. (Authors)

18840. Shapiro, Steven M. (Mass. Coop. Fishery Res. Unit, 204 Holdsworth Hall, Univ. of Mass., Amherst, Massachusetts 01002). 1975. A BIBLIOGRAPHY OF THE SPOTTAIL SHINER, Notropis hudsonius (Clinton) (PISCES: CYPRINIDAE). Publication No. 43 of the Mass. Coop. Fish. Res. Unit, 47 p.

This bibliography contains over 400 references to the spottail shiner, Notropis hudsonius (Clinton), a widely distributed minnow in central Canada and north-central and eastern United States. Subject, author, taxonomic, and geographic indices are included to the papers which deal primarily with abundance, distribution, food habits, and life history. (Auth.)

18841. Huckabee, J. W., C. Feldman, and Y. Talmi (Oak Ridge National Lab., Oak Ridge, Tennessee). 1974. MERCURY CONCENTRATIONS IN FISH FROM THE GREAT SMOKY MOUNTAINS NATIONAL PARK. Analytica Chimica Acta, 70(1): 41-47; Selected Water Resources Abstracts, 8(4): p. 49.

Excessive mercury concentrations ostensibly due to pollution were widely reported in fish tissue. A collection for mercury analysis of 198 fish of five species was made in 1972 in three high altitude streams in the Great Smoky Mountains, 20-25 km from the nearest pollution source. Mercury concentrations were (means, ppm): rainbow trout (Salmo gairdneri), 0.036; brook trout (Salvelinus fontinalis), 0.018, banded sculpin (Cottus carolinae), 0.025; rosyside dace (Clinostomus funduloides), 0.044; stoneroller (Campostoma anomalum), 0.039. There was no significant difference in mercury concentration among fish analyzed as a whole, with gastrointestinal tract removed, or a strip of axial musculature. There was a significant (P greater than 0.05) difference in mercury concentration among species in one stream and in three species from different streams. A second collection of fish of the same species in 1973 verified the 1972 results. Methylmercury constituted 93 plur or minus 2.6% of total mercury. The results indicated that all fish acquire about the same tissue concentrations of mercury at chronic exposure to very low levels.

18842. Gilmartin, Malvern, and Noelia Revelante (Australian Inst. of Mar. Sci., P. O. Box 1104, Townsville, Queensland 4810, Australia). 1975. THE CONCENTRATION OF MERCURY, COPPER, NICKEL, SILVER, CADMIUM, AND LEAD IN THE NORTHERN ADRIATIC ANCHOVY, Engraulis encrasicholus, AND SARDINE, Sardina pilchardus. NOAA Fishery Bulletin, 73(1): 193-201.

Levels of mercury, copper, nickel, silver, cadmium, and lead were determined in various tissues of the northern Adriatic anchovy, Engraulis encrasicholus, and sardine, Sardina pilchardus, throughout a 7-month fishing season. The highest concentration of nickel, silver, cadmium, and lead occurred in the skin and gills, with little interspecific differences and no unusually high values. The highest concentration of mercury and copper occurred in internal tissues, with the anchovy showing markedly higher concentrations than the sardine. Total mercury concentrations in anchovy muscle ranged from 70 to 215 nanograms per gram wet weight, concentrations 2-4X greater than in the same or similar anchovy species off northwestern Africa, southeastern United States, and California. (Authors)

18843. Henderson, Scott (Arkansas Game and Fish Comm., Lonoke, Arkansas). 1974. PRELIMINARY STUDIES ON THE TOLERANCE OF THE WHITE AMUR, Ctenopharyngodon idella, TO ROTENONE AND OTHER COMMONLY USED POND TREATMENT CHEMICALS. Proc. 27th Ann. Conf. of Southeastern Game & Fish Commissioners, Oct. 14-17, 1973, pp. 435-447.

The White Amur, Ctenopharyngodon idella, was found to be able to withstand recommended pond treatment concentrations of potassium permanganate, formalin, copper sulfate, and malachite green. In all instances, 100% of the test fish survived a 96 hour tolerance period at concentrations above the dosages recommended and used by the Arkansas Game and Fish Commission for disease and vegetation control in earthen ponds. Both rotenone and antimycin were bio-assayed for possible use as a toxicant selective toward the White Amur. Both show promise as 100% mortality was recorded for test fish at extremely low concentrations in aquariums. (Auth.)

18844. Denoncourt, Robert F., and John W. Stambaugh, Jr. (York Coll. of Pennsylvania, York, Pennsylvania 17405). 1974. AN ICHTHYOFAUNAL SURVEY AND DISCUSSION OF FISH SPECIES DIVERSITY AS AN INDICATOR OF WATER QUALITY, CODORUS CREEK DRAINAGE, YORK COUNTY, PENNSYLVANIA. Proc. Pa. Acad. Sci., Vol. 48, pp. 71-78.

This study, part of a series on the Codorus Creek system, reports on the distribution of fishes and variation of selected physical parameters. Emphasis is placed upon the West Branch and Main Codorus Creek which were considerably deteriorated by drought and/or pollution through the late 1960s. Some 39 species of fishes and 2 hybrid combinations are recorded from 54 collections taken at 14 stations from November 1970 to June 1973. Species diversity is discussed. Total number of species, mean number of species, diversity indices and dissolved oxygen indicate deterioration in water quality below the municipalities of Spring Grove and York. The results represent base-line data for comparison with future studies as communities and industries seek to improve water quality. (Authors)

18845. Weaver, James E., and Luther F. Holloway (La. Coop. Fish. Unit., La. State Univ., Baton Rouge, Louisiana 70803). 1974. COMMUNITY STRUCTURE OF FISHES AND MACROCRUSTACEANS IN PONDS OF A LOUISIANA TIDAL MARSH INFLUENCED BY WEIRS. Contributions in Marine Science, Vol. 18, pp. 57-69.

Surface and otter trawl samples for fishes and macrocrustaceans were made monthly from March through September, 1968 in eight tidal ponds at Marsh Island, Louisiana, an estuarine system partially influenced by weirs. Based upon combined surface and otter trawl samples, two communities that occupied distinct habitats were inferred: an open-water community in the unweired and weired non-vegetated ponds and a vegetated community in the weired vegetated ponds. Submerged vegetation areas, which weirs encourage, were utilized more by juveniles and adults of resident species than by transient juveniles of certain commercially important species such as gulf menhaden, Atlantic croaker, spot, and white shrimp. Examination of ingested materials in selected fish species indicated the importance of organic detritus, benthos, and zooplankton to the open-water community and the dietary influence of submerged vegetation and its associated fauna and epiflora to the vegetated community. (Authors)

18846. Schiewe, Michael H. (Northwest Fish. Center, NMFS, NOAA, 2725 Montlake Blvd., East, Seattle, Washington). 1974. INFLUENCE OF DISSOLVED ATMOSPHERIC GAS ON SWIMMING PERFORMANCE OF JUVENILE CHINOOK SALMON. Trans. Amer. Fish. Soc., 103(4): 717-721.

Juvenile chinook salmon, Oncorhynchus tshawytscha, were exposed to selected levels of dissolved atmospheric gas ranging from 100 (control) to 120% of saturation, and surviving fish were then tested for maximal swimming performance. Decreased swimming ability resulted from exposure to concentrations ranging from 106 to 120% of saturation if the fish were tested immediately; other tests indicated that recovery of swimming abilities occurred within 2 hr if the fish were returned to equilibrated water (100% of atmospheric saturation) before testing. (Auth.)

18847. Bengtsson, B.-E. (Dept. of Biol., Univ. of Umea, Sweden). 1974. EFFECT OF ZINC ON GROWTH OF THE MINNOW Phoxinus phoxinus. Oikos, 25(3): 370-373.

Reduced growth occurred in yearlings and adults of the minnow Phoxinus phoxinus L. following exposure to zinc nitrate in fresh water over a 150-day period. Yearlings were more sensitive than adults and showed reduced growth at 0.13 ppm zinc (corresponding to 1/25 of the estimated 96-hr LC50). Suppressed growth was associated with reduced Tubifex consumption. (Auth.)

18848. Axon, James R. 1974. EVALUATION OF THE "TWO-STORY" TROUT FISHERY IN LAKE CUMBERLAND. Kentucky Fisheries Bulletin No. 60, 69 p.

Lake Cumberland has been stocked with rainbow trout (Salmo gairdneri Richardson) since 1962. A "two-story" trout fishery has been established in the lower section of the lake, but with marginal success. Trout have adequate habitat, and forage, in the form of threadfin shad, Dorosoma petenense (Gunther), throughout the year. When stocked at 203 mm (8 in.), trout approximately doubled their length and increased their weight tenfold. The vertical distribution study revealed that trout were most active from 4 pm to midnight during the summer months. It was during this period, particularly between sunset and midnight, that a majority of the trout were sought after and caught. The best year for trout fishing during the investigation was in 1969, when trout were harvested at a rate of 0.16 fish per hour from May through September. As the water temperatures increase during the summer, trout have a tendency to seek lower depths. The depths that trout prefer are primarily dependent upon water temperature. During the distribution study, the greatest frequency of occurrence for trout was between 59° and 63°F. The greatest depth at which a trout was captured was 73 feet in August of 1972. The two major problems encountered in developing the trout fishery in Lake Cumberland are the loss of trout by predation, and escapement through the discharge at the dam. By stocking trout that average 230 mm (9 in.) in length, most of the predation by black basses can be avoided. Results of the predation studies indicated that black basses utilized trout that were less than 203 mm (8 in.) in length. Whether the stocking of 230 mm trout will also reduce predation by striped bass, Morone saxatilis (Walbaum), is questionable. To minimize the escapement of trout through the dam, trout should be stocked a safe distance from the dam, preferably at Ramsey's Point (20 miles above dam). A more suitable stocking location would be at Rowena Ferry (4.5 miles above dam), but the lake is being held at least 23 feet below normal summer pool through 1979 in order to repair the dam. A greater-than-normal annual discharge is anticipated to keep the lake at this lower level, so Ramsey's Point appears to be a more appropriate stocking site until the dam is repaired. The stocking date, either October or February, had an enormous effect on the harvest. Trout stocked in February contributed more to the catch than did the October stocking every year between 1969 and 1972. In 1971, returns from the February stocking outnumbered returns from the October 1970 stocking by a ratio of 74:1. Since 1971, trout have been stocked in either late January or in February. A re-evaluation of the trout fishery in Lake Cumberland should be made after the fishery has been given at least three years to develop following the recommendations described. (Auth.)

18849. Briggs, Philip T. 1975. SHORE-ZONE FISHES OF THE VICINITY OF FIRE ISLAND INLET, GREAT SOUTH BAY, NEW YORK. N. Y. Fish Game J., 22(1): 1-12.

In 1970 and 1971, during the summer and fall, 57 species of fish were seined in the vicinity of Fire Island Inlet. The Atlantic silverside was the most numerous and most frequently caught fish, followed by the northern pipefish, although greater numbers of other species were seined. Observations of several species of interest due to either their rarity or unusual abundance are treated separately. Among the factors that appeared to influence the abundance and distribution of shore-zone fishes in the area were bottom type and vegetative cover, the nearness of the Atlantic Ocean and wind velocity. (Auth.)

18850. Funk, John L., and John W. Robinson (Fish and Wildl. Res. Center, Missouri Dept. of Conservation, 1110 College Ave., Columbia, MO 65201). 1974. CHANGES IN THE CHANNEL OF THE LOWER MISSOURI RIVER AND EFFECTS ON FISH AND WILDLIFE. Mo. Dept. Conservation Aquatic Series 11, 52 p.

Fourteen pairs of maps were reproduced from a set of maps published by the Corps of Engineers. One map of each pair shows a section of the Missouri River between the mouth and Rulo, Nebraska as it was in 1879, the other as it was in 1954. The Corps' hydrographic survey was used to bring channel changes up to date (1972). In the 93-year period this portion of the Missouri River has been shortened 8%. The water surface area has been reduced by 50%, unconnected islands have been reduced in area by 98%, and the bank to bank area has been reduced by 27%. The land and water lost from the public domain was fish and wildlife habitat, in most instances much better than that which remains. These changes were brought about by the use of revetments along eroding banks, and pile dikes to divert and direct the current, with the pile dikes being converted to rock dikes in recent years. The rationale was improvement of the river for navigation. During the 19th century river steamboats were the chief carriers of freight for the growing West. The Corps of Engineers were involved first in the removal of snags, after 1884 in systematic development through the Missouri River Commission, which they dominated, and after 1902 on their own responsibility. Although the steamboat era was over by 1902, a 6-foot channel to Kansas City was authorized in 1912, it was extended to Sioux City in 1927 and in 1945 a 9-foot channel to Sioux City was authorized. Early accounts give the impression that the fishery resources of the river was great, taken for granted and heavily exploited. Abundant large sturgeon were caught at first only for their roe (caviar), later the flesh was smoked (a delicacy). When sturgeons declined in abundance large paddlefish were exploited in the same way. Large blue catfish were abundant. The record fish weighing 315 pounds was caught in 1866. Available records suggest that the harvest of commercial fish reached a peak about 1900 and has declined since. Coincidence of this decline with intensified channelization of the river is remarkable. Since 1940 commercial fishermen have been required to report their catches. The quantity of fish caught has declined rather steadily to the modern low of about 300,000 lb per year. Carp, introduced in 1880, quickly expanded to make 50% or more of the commercial catch, apparently displacing the buffaloes. Flathead catfish have declined in recent years, but channel catfish seem to be increasing. Early travelers on the river lived off the land and killed large numbers of deer, turkeys, and other game. An incentive for traveling up the Missouri was to obtain the pelts of beaver, otter and other furbearers. Lewis and Clark mentioned migrating waterfowl and also geese, ducks and swans which reared their young on the river. The abundance of wildlife had been greatly reduced by the 20th century. Clearing of the bottomland forest and especially the river margins and former islands greatly reduced the amount of habitat for deer, turkeys etc. The loss of the sloughs, backwaters and bottomland lakes greatly reduced the habitat for beaver, otter, muskrat, raccoon and waterfowl and so the populations of these animals. Deer have made a remarkable comeback in Missouri in the past 30 years. The largest and most productive animals are produced along the Missouri River but numbers are limited by available forest cover. The wood duck is the only waterfowl which nests in numbers along the river and it is limited by lack of tree-hole nest sites and quiet backwaters for feeding. Migrant ducks use the river and in some years rather large numbers may spend most of the winter on it. Many Canada geese winter in Missouri, chiefly on well-managed refuges but some use the river. The quantity of waterfowl that the river can support has been greatly reduced by channelization. (Authors)

18851. Roales, R. R., and A. Perlmutter (Lab. of Aq. Biol., Dept. of Biol., Grad. School of Arts and Sci., N. Y. Univ., New York, N. Y. 10003). 1974. TOXICITY OF METHYLMERCURY AND COPPER, APPLIED SINGLY AND JOINTLY, TO THE BLUE GOURAMI, Trichogaster trichopterus. Bull. Environ. Contamin. Toxicol., 12(5): 633-639.

The 24, 48 and 96 hour Tl_m for methylmercury and copper were determined for adult blue gouramis. In addition, it was found that copper at low to moderately-high doses appears to be antagonistic to the toxic action of methylmercury in these fish. (Authors' summ.)

18852. Moav, Rom, and G. W. Wohlfarth (Genetics Dept., The Hebrew University, Jerusalem). 1974. MAGNIFICATION THROUGH COMPETITION OF GENETIC DIFFERENCES IN YIELD CAPACITY IN CARP. Heredity, 33(2): 181-202.

Ten experiments were carried out during the period 1961-69. In each experiment a pair of genetically different groups of carp was tested simultaneously for differences in growth rate in mixed ponds as well as in separate ponds. The aim of the experiments was to estimate the genetic correlation of relative growth rate under inter-group competition in mixed ponds and in the absence of inter-group competition in separate ponds. The estimate of the genetic correlation coefficient was found to be 1.0, and that of the regression coefficient of growth rate in mixed ponds on growth rate in separate ponds was 2.0. The inter-group genetic variance in mixed ponds was four times higher than that of the variance in separate ponds. The higher variance in mixed ponds was partitioned into a component dependent on growth rate in separate ponds and a second independent component. The high genetic correlation means that the dependent component could account for all the amplification of the variance in the mixed ponds and that, apparently, in carp there are no specific genetic factors affecting growth rate under competition. The practical implications of this result for carp breeding is that selection for the improvement of yield capacity can be performed more effectively in mixed ponds than in separate ponds. A theoretical model for analysis of competition is presented and discussed. (Authors' summ.)

18853. Casselman, John M. (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada M5S 1A1). 1974. ANALYSIS OF HARD TISSUE OF PIKE Esox lucius L. WITH SPECIAL REFERENCE TO AGE AND GROWTH. In: T. B. Bagenal (ed.) Ageing of fish--Proc. of an international symposium, Reading, England, July 19-20, 1973, pp. 13-27.

Quantitative and qualitative analysis of pike Esox lucius Linnaeus cleithra from three populations were investigated in relation to age and growth. Appositional growth of opaque and translucent zones in cleithra from a natural pike population were examined with the use of tetracycline antibiotics. An average of 80% of the annual linear cleithral growth, representing the opaque zone, was depositied during 22% of the calendar year confirming that the opaque zone forms at a much faster rate than the translucent zone. Cleithra from slower growing pike were significantly smaller at any specific body length. These cleithra transmitted more light than faster growing ones of the same size because they not only contained relatively more translucent annuli which were often wider but also had opaque zones that were optically less dense and contained more pseudoannuli. Zones in hard tissue are described as translucent and opaque in transmitted light and as absorptive and reflective in reflected light. Macroanalysis demonstrated that specific gravity and ash residue of whole and sectioned parts of cleithra increased with increasing age and decreasing growth rate. Nitrogen content was inversely related to specific gravity and ash. These results were observed not only between cleithral parts but also between individuals and populations. Microanalysis conducted with an electron microprobe X-ray analyser revealed differential calcification of the zones. Calcium and total mineral content of both zones increased with increasing age and decreasing growth rate. Calcium was uniformly high in the translucent zone but was lower and more variable in the opaque zone. Calcium and total inorganic content were significantly higher in the translucent than in the opaque zone, when the same volumes of tissue were compared. Changes in the relative amounts of both organic and inorganic material in calcified tissue influence the transmission and reflection of light, resulting in optically different zones. The role of protein metabolism and matrix production in appositional growth of fish calcified tissue and differential calcification in check and translucent zone formation are considered. (Auth.)

18854. Mason, J. C. (Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1974. MOVEMENTS OF FISH POPULATIONS IN LYNN CREEK, VANCOUVER ISLAND: A SUMMARY FROM WEIR OPERATIONS DURING 1971 AND 1972 INCLUDING COMMENTS ON SPECIES LIFE HISTORIES. Environ. Canada, Fish. and Mar. Service Technical Report No. 483, 35 p., Manuscript status.

18855. Benfield, Ernest F., Albert C. Hendricks, and John Cairns, Jr. (Dept. of Zool., Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1974. PROFICIENCIES OF TWO ARTIFICIAL SUBSTRATES IN COLLECTING STREAM MACROINVERTEBRATES. Hydrobiologia, 45(4): 431-440.

Proficiencies in collecting stream macroinvertebrates by two types of artificial substrates, No. 200 3M conservation webbing and cone-shaped concrete blocks, were compared with bottom net collections. Conservation webbing collected more individuals than cone substrates, but fewer taxa than either cone substrates or bottom nets. Diversity indices calculated for collections made with the three techniques were lowest for webbing collections, highest for net collections and intermediate for cone collections. It was concluded that collections made with webbing substrates gave an extremely distorted view of macroinvertebrate community balance due to a preponderance of net spinning and case building forms, and that cone substrates were better suited for use in the particular situation studied. (Authors)

18856. Powell, Douglas H. (Alabama Dept. of Conservation and Nat. Resources, Game and Fish Div., Fish. Section, Montgomery, Alabama). 1974. COMPARATIVE TOLERANCE OF FINGERLING BLACK CRAPPIE, WHITE CRAPPIE, AND LARGEMOUTH BASS TO FINTROL-5 AT TWO pH LEVELS. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 448-454.

A comparison of tolerance of fingerling black crappie, white crappie and largemouth bass to Fintrol-5 was conducted in aquaria. White crappie were found to be more susceptible to Fintrol-5 than were black crappie and largemouth bass. Largemouth bass and black crappie showed similar tolerance to the toxicant. The mortality of largemouth bass and black crappie was significantly reduced at a pH of 8.0-8.5. All three species suffered significant mortalities beginning with .04 ppm Fintrol-5 at a pH of 7.0. One ppm KMn04 significantly reduced mortality by detoxifying Fintrol-5. (Auth.)

18857. Edwards, D. J., and P. M. Hine (Fish. Res. Div., Min. of Agric. and Fish., P. O. Ngapuna, Rotorua, New Zealand). 1974. INTRODUCTION, PRELIMINARY HANDLING, AND DISEASES OF GRASS CARP IN NEW ZEALAND. Reprint: N. Z. J. Mar. Freshwater Res., 8(3): 441-454.

Fry of grass carp, Ctenopharyngodon idella (Val.) were air-freighted from Hong Kong to New Zealand in October 1971. The fish were at first kept in tanks with a recirculating water supply, where they soon showed symptoms of parasitic infestation and suffered heavy mortality. Attempts were made to remove parasites with chemotherapeutic treatment. Tripartiella sp., Dactylogyrus ctenopharyngodonis, and Gyrodactylus ctenopharyngodontis were eliminated by prolonged bathing of the infected fish with quinine. Chemical treatment failed to eliminate Ichthyophthirius multifiliis from the body surface and the gills, but the rate of spontaneous recovery of the fish from this disease was accelerated by keeping them in clean, running water. Experiments to remove the cestode Bothriocephalus gowkongensis from the intestine of the fish with tetravalent tin compounds and to control the intermediate host (Cyclops) in the water resulted in the eradication of the cestode. (Authors)

18858. Ahmed, A. T. A. (Dept. Fish., Fac. Agr., Univ. Tokyo, Japan). 1974. KIDNEY ENLARGEMENT DISEASE OF GOLD FISH IN JAPAN. Jap. J. Zool., 17(2): 37-67 plus plates; Fish Health News, 4(1): p. 14.

In 1963, a new disease affecting the kidneys of goldfish were noted in Japanese fish firms and referred to as "kidney enlargement disease". By 1971, losses in some groups were as high as 20%. This paper described and illustrates the course of the disease and the development of the parasite causing kidney enlargement disease. This disease was first noted in goldfish in Japanese fish farms in 1963. Since then, the severity has increased to where mortality may be as high as 20% (1971). The disease is caused by the Myxosporidian Mitraspora cyprini. It is characterized by marked enlargement of the kidneys and/or ureters resulting in a grossly swollen abdomen. Fish hatched in spring become infected during late spring and summer via spores shed by survivors of the previous years infection. Signs are first noted in September and increase through the winter. Mortality tends to occur during the winter and early spring. -- R. L. Herman

18859. Stalling, David L., James W. Hogan, and James L. Johnson (Fish-Pesticide Res. Lab., U. S. Fish & Wildl. Service, Columbia, Missouri 65201). 1973. PHTHALATE ESTER RESIDUES - THEIR METABOLISM AND ANALYSIS IN FISH. Environ. Health Perspectives, Jan. 1973, pp. 159-173.

Fish from various locations in the United States have been analyzed for DEHP by GLC. Residue levels ranged from 0.2 to 10.0 μg/g on a whole fish basis. Higher phthalate ester residues appear to be associated with industrialized areas. Significant residues also occurred in commercially reared channel catfish and dietary contamination was suspected as the source of the phthalate ester. Laboratory contamination from plastics was a critical problem and was minimized by replacement of blender seals and tubing with Teflon or polyethylene. Metabolism of the esters occurred in in vivo and in vitro studies with fish. Static exposures of catfish (2 g) to 1 μg/l of ^{14}C-labeled DEHP for 24 hr resulted in tissue residues of 2.6 μg/g. The composition of the radioactive residues was examined by TLC. Four metabolic products were separated and identified as: mono-2-ethylhexyl phthalate, the corresponding monoester glucuronide (unknown aglycone), phthalic acid, and a phthalic acid glucuronide. The monoester was the predominant metabolite identified by TLC. DBP was metabolized in vitro sixteen times more rapidly than DEHP by hepatic microsomes from male channel catfish. Formation of monoester metabolites of di-n-butyl and di-2-ethylhexyl phthalates was not inhibited by carbon monoxide and did not require NADPH. Formation of three other unidentified metabolites, however, was inhibited by carbon monoxide and did require NADPH. The phthalic acid monoesters were not further metabolized and appeared to be a terminal metabolite for the in vitro system under study. At least two separate and distinct enzyme systems appeared to metabolize phthalic acid diesters in vitro. Metabolic products were separated by TLC by using Brinkman 0.25 mm silica gel plates and a petroleum ether:diethyl ether:acetic acid (77:20:3, v/v/v) developer. Individual components were recovered from the TLC plates, derivatized with diazomethane, and identified by GLC-MS. The spectra of resultant dimethyl phthalate, methyl n-butyl phthalate, and methyl 2-ethylhexyl phthalate were identical to those of the corresponding synthetic esters. Graphical presentation of mass fragments in sequential GLC-MS scans using the PDP-12 LDP computer was extremely useful in examining the metabolites and parent compounds. Routine analysis of phthalate esters and metabolic products required multiple clean-up techniques prior to GLC analysis. Diesters were recovered by conventional residue extraction techniques. Chromatography of these esters of Florisil was analagous to chromatography of dieldrin. Glucuronide conjugates of the phthalic acid monoesters must be enzymatically hydrolyzed and recovered prior to derivatization and GLC analysis. Recovery of the glucuronides from tissue (20 g) was achieved by column extraction using 200 ml of 1% H_3PO_4 in acetone. The extract concentrated to 20 ml, was dissolved in 200 ml of water and the pH was adjusted to pH 4.5 and buffered with acetate buffer. The glucuronide was hydrolyzed by incubation with Ketodase (5 ml) for 24-48 hr at 37°C. The pH was lowered to 1.5 with H_3PO_4, and the monoester and phthalic acid extracted with diethyl ether. After evaporation, the extract was dried with Na_2SO_4 (anhydrous) and derivatized with diazomethane prior to GLC analysis. Derivatization of the PAE monoesters with diazomethane was satisfactory. Dimethyl phthalate, however, has an extremely short GLC retention time, and di-2-chloroethyl phthalate was a more suitable derivative for phthalic acid. The electron capture detector was sensitive to the phthalate esters and detector response was approximately 20% of the response for DDE. Additional investigations have been undertaken to establsih which derivatives of the phthalate ester metabolites are suitable for gas chromatographic analysis. The methyl and n-butyl 3-0-trifluoroacetyl phthalates and trimethylsilyl derivative of 3-hydroxyphthalatic acid were examined by GC-MS. Only the trimethylsilyl derivative gave satisfactory chromatographic peaks. The mass spectrum of the TMS derivative (MW=398) was as follows (m/e$^+$:I): 73:100; 221:60; 147:58; 383:52 (P^+-15); 193:21; 295:14; 282:6; 398:2. The TMS derivative eluted at 220°C by use of a 10% SE-30 column programmed from 120 to 240°C at 6.5°C/min with ca. 20 ml/min of a He carrier flow. (Auth.'s summ.)

18860. Peterson, R. H. (Dept. of the Environ., Fish., and Mar. Serv., Biol. Sta., St. Andrews, New Brunswick E0G 2X0, Canada). 1974. INFLUENCE OF FENITROTHION ON SWIMMING VELOCITIES OF BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Board Can., 31(11): 1757-1762.

The critical swimming velocities of brook trout (Salvelinus fontinalis) following exposure to 150, 500, and 1500 μg/liter fenitrothion were 100, 83, and 70%, respectively, of the performance of control fish. This represented 35 and 60% decrease in power output, respectively, for the two higher concentrations. At step-test intervals longer than 15 min, the critical velocity (ca 4.5-5 lengths [L]/s) was reasonably constant. At shorter step-test intervals, the critical velocity increased rapidly to exceed 7L/s at a step-test interval of 30 s. The cruising speed of control fish was estimated at 4.5 L/s. The influence of fenitrothion exposure on swimming speed is related to previous studies on sublethal effects of fenitrothion and to concentrations in streams resulting from insecticide spraying. (Auth.)

18861. Westlake, G. F., H. Kleerekoper, and J. Matis (Virginia Polytechnic Inst. and State Univ., Center for Environ. Studies, Blacksburg, Virginia). 1974. THE LOCOMOTOR RESPONSE OF GOLDFISH TO A STEEP GRADIENT OF COPPER IONS. Water Resources Research, 10(1): 103-105; Selected Water Resources Abstracts, 8(4): p. 51.

The intent was to verify whether the previously observed attraction of goldfish to a sublethal concentration of copper ions presented in a shallow gradient also occurs when the fish are confronted with a steep gradient of the same concentration. The locomotion of goldfish exposed to laboratory water and a steep gradient of 'copper-polluted' water in a free choice situation was monitored to establish the orientation of the fish in relation to the copper-containing mass of water. Separate tests were made for 0.005, 0.01, 0.025 and 10.0 ppm Cu(++) at 21 C plus or minus 1 degree in continuously flowing water. In all concentrations the number of entries into the copper affected zone and the time spent there per entry decreased significantly. Absolute avoidance of the copper-containing water mass did not occur even at 10.0 ppm. It is apparent that the locomotor response of the fish is dependent on the slope of the gradient of the copper ion, all other conditions being similar. A steep gradient may elicit avoidance escape; a shallow gradient may produce 'attraction'.

18862. Briggs, Philip T. 1975. AN EVALUATION OF ARTIFICIAL REEFS IN NEW YORK'S MARINE WATERS. N. Y. Fish Game J., 22(1): 51-56.

Two artificial reefs, Kismet reef in Great South Bay and Fire Island reef in the Atlantic Ocean, were studied to determine their success in attracting finfish. Kismet reef attracted large numbers of fish, with catches dominated by tautog. Fire Island reef also attracted many fish, although no one species dominated the catch. Both reefs were considered successful. Kismet reef was often overcrowded in the fall, and expansion to its full authorized area seems desirable. Future artificial reef building in New York waters might best be directed toward the south shore bays and similar sheltered waters, although present oceanic reefs should not be abandoned. (Auth.)

18863. Kitchell, James F., Joseph F. Koonce, Robert V. O'Neill, Herman H. Shugart, Jr., John L. Magnuson, and Ray S. Booth (Lab. of Limnol., Univ. of Wisconsin, Madison, Wisconsin 53706). 1974. MODEL OF FISH BIOMASS DYNAMICS. Trans. Amer. Fish. Soc., 103(4): 786-798.

A model of fish biomass dynamics is developed based on principles of physiology, population biology, and trophic ecology. The model is designed to incorporate measurable parameters for simulating seasonal changes in a natural population. All parameters were implemented for the bluegill (Lepomis macrochirus) and simulation results compared with independently derived laboratory and field data. Applications of the model to thermal enrichment problems are given as an example of future potential uses. (Authors)

18864. Eales, J. G., and D. A. R. Sinclair (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1974. ENTEROHEPATIC CYCLING OF THYROXINE IN STARVED AND FED BROOK TROUT, Salvelinus fontinalis (Mitchill). Comp. Biochem. Physiol., 49(4A): 661-672.

Radiothyroxine ($^*T_4$) and its glucuronide conjugate ($^*T_4G$) were introduced in vivo into the small intestine of starved brook trout at 12-13°C either by injection into a doubly ligated gut loop or via an anal catheter. Plasma levels of organically incorporated radioactivity indicated poor absorption by these compounds from the intestinal lumen and limited enterohepatic cycling during starvation. Feeding caused a prompt discharge of stored radiohormone from the gall bladder of previously starved fish and a decrease in plasma levels of organic radioactivity relative to starved controls. Thus any tendency for $^*T_4$ to be absorbed into the plasma from the gut lumen in fed fish is masked by a tendency for organic radioactivity to be lost more rapidly from the plasma due to feeding. (Authors)

18865. Prather, E. E., and R. T. Lovell (Dept. of Fish. and Allied Aquacultures, Auburn Agric. Exp. Sta., Auburn, Alabama 36830). 1974. RESPONSE OF INTENSIVELY FED CHANNEL CATFISH TO DIETS CONTAINING VARIOUS PROTEIN - ENERGY RATIOS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 455-459.

Six experimental catfish feeds, containing 29, 36, and 42% crude protein at metabolizable energy (ME) levels of 1000 and 1300 kcal per lb, were fed to fingerling channel catfish in 24, 1/10-acre earthen ponds for 165 days. Each dietary treatment was randomly assigned to four ponds which were stocked at a rate of 4,000 fish per acre. Feed allowance was increased biweekly on the basis of fish weight gain until a maximum daily allowance of 40 lb per acre was reached. The higher energy plane resulted in greater weight gains, more fish protein produced per acre, and slightly fatter fish, at each dietary protein level. At the lower ME level the difference in growth among fish fed the 29, 36, and 42% protein diets was not significant (PV.05). At the higher ME level the fish showed increased gains with each increase in diet protein percentage. The high protein (42%) - low energy (1000 kcal) diet produced the lowest gain of the six treatments, indicating that high levels of protein may be toxic to catfish with low amounts of nonprotein energy. (Authors)

18866. Serchuk, Fredric M., and Charles F. Cole (Dept. of Forestry & Wildlife Mgmt., Univ. of Massachusetts, Amherst, Massachusetts 01002). 1974. AGE AND GROWTH OF THE CUNNER, Tautogolabrus adspersus (Walbaum) (PISCES: LABRIDAE) IN THE WEWEANTIC RIVER ESTUARY, MASSACHUSETTS. Chesapeake Science, 15(4): 205-213.

The scale method is a valid means for age assessment and back-calculating previous growth for the cunner, Tautogolabrus adspersus (Walbaum) in the Weweantic River estuary, Massachusetts. Examination of cunner scale growth from July through October indicates that only one annulus is formed per year, probably during late May or June. A linear body length-scale length relationship used for back-calculation of total length is: (TL = 20.35 mm + 0.7555 SR). The origin of scale development in the cunner is shown to be on the caudal peduncle at 14 mm TL. Lee's phenomenon, whereby length at age is increasingly underestimated from scales of progressively older fishes, is not evident in back-calculated growth data. The validity of using average calculated length-at-age data to describe cunner growth is demonstrated. Growth in length of Weweantic cunners is relatively slow; average back-calculated lengths for the first five years of life were 46.5, 88.3, 124.8, 153.1, and 176.5 mm TL. The von Bertalanffy equation, $l_t = 284.77\ (1 - e^{-0.1979\ (t\ -\ 0.1044)})$, adequately describes growth in length for age groups I to V. Various length-weight relationships are derived which satisfactorily characterize growth in weight of Weweantic fish. The youngest age groups of cunner exhibit the greatest relative increase in body weight and relative weight growth during the second growing season is 11 times as great as that observed during the fifth growing season. (Authors)

18867. Gallaway, Benny J., and Kirk Strawn (Texas Agric. Exp. Sta., Dept. of Wildl. Sci., Texas A&M Univ., College Station, Texas 77843). 1974. SEASONAL ABUNDANCE AND DISTRIBUTION OF MARINE FISHES AT A HOT-WATER DISCHARGE IN GALVESTON BAY, TEXAS. Contributions in Marine Science, Vol. 18, pp. 71-137.

Biological and hydrological data were collected once each month January 1968-December 1969 at 11 offshore (trawl) and 6 beach (seine) stations in the discharge area of the P. H. Robinson Generating Station at Galveston Bay, Texas. During all but hot months, most fishes appeared attracted to the effluent. During hot weather, they generally avoided the uncooled effluent in the immediate discharge area. Water temperature decreased rapidly with distance from the outfall. The heated water flowed at the bottom rather than top of the water column during 2 of the 24 collecting trips. A few Gulf menhaden (during 1 of the 2 temperature inversions) and sea catfish were killed in the summer by heat. The lowest elevated temperature a species avoided was 30 C by the Gulf menhaden. Most species were abundant in water up to 33-35 C. Sea catfish and Atlantic croaker did not strongly avoid the effluent until temperature exceeded 37 and sand seatrout and striped mullet were collected in 40 C water. The observed detrimental effects on the fish fauna in the discharge area of the power plant operating at either the 900 or 1465 mw capacity were negligible and restricted to hot months. Beneficial and potentially beneficial aspects were indicated during most months. Most fishes would not avoid the immediate discharge area if June-September effluents were cooled a few degrees before reaching Galveston Bay. Fishes are best served by no cooling of effluent during the remainder of the year. (Authors)

18868. de Kinkelin, P. (Inst. National de Recherche Agronomique, Lab. d'Ichtyopathologie, 78850 Thiverval Grignon France). 1974. BACTERIAL KIDNEY DISEASE OF SALMONIDS: FIRST OBSERVATION IN FRANCE. (Corynebacteriose des Salmonides: Premiere Observation en France). Bull. Fr. Piscic., 254(3): 3-7, in French.

A gram positive, non mobile short bacteria (size 1 x 0.5 μ, fig. 2) was demonstrated in large amounts in kidney necrosis lesions of cultured coho salmon in France. According to the literature on fish diseases, this is the first report of the existence of bacterial kidney disease in continental Europe. (Auth.'s summ.)

18869. McCraren, Joseph P. (Warmwater Fish Cultural Development Center, P.O. Box 786, San Marcos, Texas 78666). 1974. HATCHERY PRODUCTION OF ADVANCED LARGEMOUTH BASS FINGERLINGS. Proc. 54th Ann. Conf. Wes. Assoc. Game and Fish Comm., pp. 260-270.

An inaugural program directed at producing artificially-fed advanced largemouth bass fingerlings based on methods developed at the Marion, Alabama Fish Cultural Development Center, resulted in three Region 2 warmwater hatcheries rearing in excess of 35,000 bass weighing approximately 12,300 lbs. Success of the program appeared to be correlated with initial fingerling size and condition, coupled with sound management practices. Best results were obtained at two Texas hatcheries where six ponds averaging 0.6 surf. ac. each yielded bass averaging 2.5/lb., with a conversion of 1.3 at a cost/lb. of approximately $1.00 for feed, labor, and chemicals. Results of two short-term tests designed to assimilate data regarding the reportedly "delicate" nature of these fish showed that attention to handling techniques is essential. From a sample of approximately 60 forage-fed and 60 artificially-fed bass, little difference was found to exist between hematocrit and serum protein values. However, some histological differences were observed in livers of bass receiving artificial feed. The maximum transportation leading rate attempted was 2.2 lbs/gal. for a period in excess of 13 hrs. All fish were marked by cooperating states using either freeze-branding, fin-clipping, or fluorescent pigment. Two lakes in Texas and three in Oklahoma were stocked for corrective purposes at rates ranging from approximately 1-15/surface acre. (Auth.'s summ.)

18870. Taub, Stephen H., and Richard W. Gregory (U.S. Fish & Wildl. Service, Washington, D. C. 20240). 1974. ANNUAL REPORT OF THE COOPERATIVE FISHERY UNITS 1972-73. U.S. Dept. of the Interior, 108 p., illus. For sale by Supt. of Documents, U.S. Govt. Printing Office, Wash., D.C. 20402 - Price $1.50.

18871. Bullock, G. L., H. M. Stuckey, and P. K. Chen (Eastern Fish Dis. Lab., Kearneysville, West Virginia 25430). 1975. CORYNEBACTERIAL KIDNEY DISEASE OF SALMONIDS: GROWTH AND SEROLOGICAL STUDIES ON THE CAUSATIVE BACTERIUM. Appl. Microbiol., 28(5): 811-814; Fish Health News, 4(1): 15.

Comparative growth studies of 10 isolates of the Corynebacterium of salmonid kidney disease were quantified on four media. Greatest cell yield was obtained from Mueller-Hinton medium with 0.1% L-cysteine hydrochloride. Serological tests, in which rabbit antisera used against typical bacteria strains showed all to be antigenically homologous, provided a reliable method of identification. (Authors)

18872. Dudley, R. G., and R. T. Golden (Georgia Univ., School of Forest Resources, Athens, Georgia). 1974. EFFECT OF A HYPOLIMNION DISCHARGE ON GROWTH OF BLUEGILL (Lepomis macrochirus) IN THE SAVANNAH RIVER, GEORGIA. Ga. Environ. Resources Center, Atlanta, Report No. ERC-1274, 28 p., available from NTIS, Springfield, Va. 22161 as PB-236 589, $3.75 paper copy, $2.25 in microfiche; Selected Water Resources Abstracts, 8(1): p. 50.

Information was sought on the impact of the temperature and overall quality of water released from reservoirs on downstream fish populations. The particular emphasis was on the effects of cool discharges on the growth and condition of bluegill (Lepomis macrochirus), a warm water species. Two stations on the Savannah River, 2.4 and 40 km below Hartwell Dam, were sampled. For comparison with comparable streams without reservoirs, one station on the North Oconee River and one station on the Broad River were also sampled. The mean temperature of the Savannah River was about 5 degrees C below the temperature of the control streams, and temperature drops as rapid as 11 degrees C in five hours occurred in the Savannah River. Growth increments of each fish, calculated from length and scale data, indicated that growth differences between the two control streams were greater than differences between the Savannah and the control streams. In general, neither growth nor condition was significantly affected by the hypolimnion discharge. Apparently, other differences among the four locations were great enough to mask any effect of temperature on growth. The kinds of differences and their probable effects are discussed.

18873. Lewis, William M., Larry Wehr, and Duane Koehl (Fish. Res. Lab. and Dept. of Zool., Southern Illinois Univ., Carbondale, Illinois 62901). 1974. A PRELIMINARY EVALUATION OF A FISH DIET BASED ON ROASTED SOYBEANS AND FRESH FISH. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 460-464.

Two experimental fish diets, one consisting of 50% roasted soybeans and 50% fresh fish, and another consisting of 30% soybeans, 20% corn meal, and 50% fresh fish, both with vitamin and mineral supplements, were compared to Oregon pellets in a 6 week feeding trial using yearling channel catfish (Ictalurus punctatus). The experimental diets were ground, blended and pelletized by passing the ingredients through a food chopper four times. Both mixtures proved highly attractive to the fish. Fish fed either experimental diet grew as well as fish fed the Oregon pellets. The experimental diets are suggested for use in parts of the world where commercially prepared fish feeds are not available. The diets also present the possibility of using non-commercial fishes as feed for more valuable fishes. It was observed that the fish exhibited fighting when the vitamin mix was omitted. A variety of pelleted feeds for fish are now available in the United States. Included are both complete diets for raceway and cage feeding, and less complete diets that are used for feeding fish in open pond culture, where some natural food is available. These feeds are available in various sizes of dry pellets of either a floating or sinking type. In addition to these feeds, manufactured by several different companies, there is a preparation known as the Oregon pellet (Hublou, 1963; Crawford and Law, 1972). The Oregon pellet is a moist feed which requires refrigeration. It has proven highly successful in feeding trout and salmon. All of these feeds are satisfactory when they are properly used, but prepared fish feeds are not available worldwide. Further, there may be a potential for incorporating locally available non-commercial, non-game fishes into fish feeds. There is also a possibility of using fish viscera or scraps in locally processed feeds. The basic approach in preparing the diets suggested

here is the same as that used in preparing the Oregon pellet, to the extent that the moisture from the fresh fish is incorporated into the pellet. It differs, however, in that the formula is much simpler and the facilities required to prepare it are less sophisticated. The suggestion for formulation of this pellet came from the Fish Feeds and Nutrition Workshop held September 26-28, 1972, in Rapid City, South Dakota. It was suggested at this workshop that soybeans roasted at 218 C for 15 minutes, supplemented with fish meal, would approach a nutritionally complete and palatable diet for fish. We modified this suggestion by combining 50% (by weight) fresh whole ground fish and 50% roasted soybeans. In a second formulation we used 50% ground fish, 30% roasted soybeans, and 20% corn meal. Both formulations were fortified with salt mixture and a vitamin mix. (Authors)

18874. Beamish, F. W. H. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1974. APPARENT SPECIFIC DYNAMIC ACTION OF LARGEMOUTH BASS, Micropterus salmoides. J. Fish. Res. Board Can., 31(11): 1763-1769.

Oxygen consumption attributable to apparent specific dynamic action (SDA) was measured in relation to feeding level and body weight in largemouth bass, Micropterus salmoides, forced to swim at 1.7 body length/s (BL/s). Apparent SDA rose curvilinearly with ration, size, the coefficient increasing with weight of bass. For a ration of fixed percent body weight/day, apparent SDA increased curvilinearly with weight of bass, the rate being most pronounced at higher levels of food intake. Apparent SDA expressed in energy units as a percent of ration ingested did not differ significantly with weight of fish or meal size. The overall mean apparent SDA $\pm$ SD was 14.19 $\pm$ 4.19% of the energy ingested. Time required for oxygen consumption to subside to pre-feeding levels increased with ration size and weight of bass. Over the range of swimming speeds from 1.4 to 2.5 BL/s, there were no differences in apparent SDA of similar size bass fed a ration of 4% body weight/day. Similarly, time for elevated levels of oxygen consumption to return to prefeeding rates was independent of swimming speed. (Auth.)

18875. Bailey, W. M. (Arkansas Game and Fish Comm., Little Rock, Arkansas). 1972. ARKANSAS' EVALUATION OF THE DESIRABILITY OF INTRODUCING THE WHITE AMUR (Ctenopharyngodon idella, Val.) FOR CONTROL OF AQUATIC WEEDS. Paper prepared for 102nd Ann. Meeting of the Amer. Fish. Soc. and International Assoc. of Game and Fish Commissioners, Hot Springs, Arkansas, 1972, 59 p., Weed Abstracts, 23(7): 142, 1974.

Results of experiments and observations at the Joe Hogan Fish Hatchery and in Arkansas' state-owned lakes, combined with the results of other studies both in the USA and abroad, have led to the decision that the white amur is desirable from ecological, environmental, fisheries and economic standpoints. The following are among the points made concerning this fish: (1) it controls practically every submersed weed which causes problems in Arkansas; (2) some species of floating and emergent weeds are also controlled; (3) it does not compete significantly with native fishes; (4) by removing weeds, nutrients are released which actually increase the production of other fishes; (5) it differs from the common carp (Cyprinus carpio) so radically that fears that they will react on the environment in the same way are unfounded; (6) the possibility that it will spread by spawning is slight; (7) it is easily controlled or removed from mixed fish populations by the use of rotenone; (8) it is an excellent food fish and a very strong fighter and swimmer and has potential as a sport fish. (From summ.)

18876. Gabovich, Ye. Ya., and Ye. M. Malkin (All-Union Research Inst., for Sea Fish. and Oceanogr. (VNIRO), Moscow, USSR). 1974. AN ATTEMPT TO GIVE FORMAL DEFINITION TO THE BIOSTATIC METHOD OF ESTIMATING THE RELATIVE ABUNDANCE OF FOOD FISHES. J. Ichthyol., 14(1): 20-27.

One possible means is proposed for the production of an algorithm for the calculations involved in the biostatic method of estimating the relative abundance of food fishes. The computer use of the proposed algorithm will effect a marked saving in the time spent on calculations and will free research workers from the laborious calculation process.

18877. Rainboth, Walter J., Jr., and Gregory S. Whitt (Provisional Dept. of Genetics and Development, Univ. of Illinois, Urbana, Illinois 61801). 1974. ANALYSIS OF EVOLUTIONARY RELATIONSHIPS AMONG SHINERS OF THE SUBGENUS Luxilus (TELEOSTEI, CYPRINIFORMES, Notropis) WITH THE LACTATE DEHYDROGENASE AND MALATE DEHYDROGENASE ISOZMYE SYSTEMS. Reprint: Comp. Biochem. Physiol., 49B: 241-252.

Eight species of the subgenus Luxilus of Notropis (Cyprinidae) were compared with respect to their lactate dehydrogenase and malate dehydrogenase isozyme patterns. This isozymic analysis permitted the resolution of the three distinct phyletic groups within the subgenus. Extensive polymorphism was observed at the lactate dehydrogenase C locus, the function of which is restricted primarily to the liver. (Authors)

18878. Kaesler, Roger L., John Cairns, Jr., and John S. Crossman (Dept. of Geol., Univ. of Kansas, Lawrence, Kansas 66045). 1974. REDUNDANCY IN DATA FROM STREAM SURVEYS. Reprint: Water Research, Vol. 8, pp. 637-642.

Data on the distribution of the biota of streams may be unnecessarily expensive and time-consuming to collect because of redundancy of information provided by various groups of organisms. Using correlation coefficients computed between corresponding elements of Q-mode similarity matrices, it was found that in the upper Potomac River aquatic insects gave the best agreement with the total biota of any subset tested ($r = 0.603$). In the Clinch River, similarities among stations based on occurrences of Ephemeroptera and Coleoptera agreed most closely with similarities based on the total insect fauna, but the two orders were not closely similar to each other. This result suggests that study of both groups may reveal most of the information provided by the total insect fauna. Associations among stations based on occurrences of Gastropoda were closely similar to those based on the total noninsect macroinvertebrate fauna. (Authors)

18879. Evenhuis, Bernard L. 1974. INVENTORY AND CLASSIFICATION OF STREAMS IN THE LITTLE SANDY RIVER, TYGART'S CREEK AND KINNICONICK CREEK DRAINAGES. Kentucky Fisheries Bulletin No. 58, 26 p.

Streams in the Little Sandy River, Tygart's Creek and Kinniconick Creeks have been listed and classified on the basis of stream order. Some physical, chemical, and biological characteristics of the streams are described as well as the general characteristics of the fishery. These three drainages include a total of 1,259 square miles. Of this, a total of 318 linear miles have been determined capable of supporting a stream fishery. Six streams (227 miles) are considered to be of outstanding quality. A total of 59 species representing 15 families have been identified from the Little Sandy River, Tygart's Creek, and Kinniconick Creek Drainages. The fantail darter was the most frequently collected species in these drainages. The most frequently collected game species has been the spotted bass with the longear sunfish being the most frequently collected pan fish. (Auth.)

18880. Graynoth, E. (Fish./Mgmt. Div., Min. of Agric. and Fish., Wellington, New Zealand). 1974. NEW ZEALAND ANGLING 1947-1968. AN ASSESSMENT OF THE NATIONAL ANGLING DIARY AND POSTAL QUESTIONNAIRE SCHEMES. N. Z. Min. of Agric. and Fish., Fisheries Technical Report No. 135, 70 p.

This report analyzes the value of statistics collected through the New Zealand national angling diary and postal questionnaire schemes run from 1947 to 1967 and complements the district reports based on these statistics (Graynoth 1973 a-b, 1974 a-d, Graynoth and Skrzynski 1973 a-d, 1974 a-d). A total of 5,500 diaries returned by freshwater anglers contained details of 100,000 days angling and 260,000 fish caught in several hundred waters throughout New Zealand. A summary of the basic angling statistics from 129 major waters is included. The objective in collecting these data was to monitor the state of the fish stocks, the size and nature of the fishing effort and the size and distribution of the angling catch using angling statistics. This report therefore contains a detailed review of the variables which influence angling statistics and the consequent conclusions which may be made from them. (From Auth.'s summ.)

18881. Yurkowski, M., and Jo-Anne L. Tabachek (Dept. of the Environ., Fish., and Mar. Serv., Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1974. IDENTIFICATION, ANALYSIS, AND REMOVAL OF GEOSMIN FROM MUDDY-FLAVORED TROUT. J. Fish. Res. Board Can., 31(12): 1851-1858.

Geosmin has been isolated and identified, using gas-chromatographic, mass-spectrometric, and organoleptic analysis, as the principal compound responsible for the muddy flavor in fish from various saline lakes in western Canada. A method for quantitative estimation of geosmin has been described and evaluated. Placing of muddy-flavored rainbow trout (Salmo gairdneri) in clean water resulted in reduction of flavor to the borderline level between 3 and 5 days, and of geosmin concentration from 1.1 to 0.3 μg/100 g of flesh in 14 days. The taste threshold level of geosmin was estimated to be 0.6 μg/100 g flesh. (Authors)

18882. Lindall, William N., Jr., William A. Fable, Jr., and L. Alan Collins (Environ. Assessment Div., NMFS, NOAA, St. Petersburg, Florida 33702). 1975. ADDITIONAL STUDIES OF THE FISHES, MACROINVERTEBRATES, AND HYDROLOGICAL CONDITIONS OF UPLAND CANALS IN TAMPA BAY, FLORIDA. NOAA Fish. Bull., 73(1): 81-85.

Hydrological and biological data from a concluding study of upland canals in Tampa Bay, Florida are presented and compared with those collected the previous year. Critically low levels of dissolved oxygen occurred more frequently and over a longer period of time in the second year. Most affected were the inland portions of the canal system where the number of species declined markedly over the previous year. Impoverishment of fauna on or near the bottom is expected to recur during summer months because of oxygen depletion resulting from a combination of continuing accumulation of decomposing organic sediment, warm water, and little circulation in the dead-end canals. (Authors)

18883. Reed, J. R., G. L. Samsel, R. R. Daub, and G. C. Llewellyn (Dept. of Biol., Virginia Commonwealth Univ., Richmond, Virginia 23220). 1974. OXIDATION POND ALGAE AS A SUPPLEMENT FOR COMMERCIAL CATFISH FEED. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 465-470.

Investigations have shown that small (less than 10 cm) channel catfish fingerlings, Ictalurus punctatus Rafinesque, gained as much weight in a 10 week period on a diet of 25%-75% oxidation pond algae-commercial feed as did control animals fed 100% commercial feed. Larger fish (20-25 cm) fed the algal-supplemented diet did not gain as much weight in 10 weeks as did control fish on 100% commercial feed. Whole body protein and fat levels did not differ significantly between control and experimental fish. (Authors)

18884. Perrier, Henri, J. P. DelCroix, C. Perrier, and J. Gras (Dept. of Pharm. Biochem., Univ. Claude Bernard, U.E.R. of Pharmaceutical Sciences, 8 Rockefeller Ave., 69373 Lyon Cedex 2, France). 1974. DISC ELECTROPHORESIS OF PLASMA PROTEINS OF FISH. PHYSICAL AND CHEMICAL CHARACTERS; LOCALIZATION OF FIBRINOGEN, TRANSFERRIN AND CERULOPLASMIN IN THE PLASMA OF THE RAINBOW TROUT (Salmo gairdnerii Richardson). Comp. Biochem. Physiol., 49(4B): 679-685.

After disc electrophoresis with 9% acrylamide gel, specific staining showed the existence of a pattern in rainbow trout plasma protein of six glycoprotein bands and two lipoprotein bands. Thermostable and perchlorosoluble fractions were observed. Fibrinogen (band 12), transferrin (band 4) and ceruloplasmin (band 7 or 8) were localized. An hemoglobin-binding protein was not found. A particular glycolipoprotein complex was noted. An analogous compound was found in the plasma of eleven fish species. The results presented show the impossibility of correlating any fraction with mammalian serum albumin. (Authors)

18885. Joseph, Edwin B. (S. C. Marine Resources Research Lab., South Carolina). 1974. PRESENT STATUS AND FUTURE TRENDS IN COASTAL AND ESTUARINE FISHERIES MANAGEMENT. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 386-391.

18886. Meldrim, John W., James J. Gift, and Bernard R. Petrosky (Ichthyological Associates, Inc., 100 South Cass St., Middletown, Delaware 19709). 1974. THE EFFECT OF TEMPERATURE AND CHEMICAL POLLUTANTS ON THE BEHAVIOR OF SEVERAL ESTUARINE ORGANISMS. Ichthyological Associates, Inc. Bulletin No. 11, 129 p.

To determine the limits of ecological alteration, the limits of habitable conditions for affected species must be known. In general, these limits are more appropriately defined in terms of behavioral avoidance responses and physiological requirements and capabilities than in terms of lethal tolerance levels. Due to the increased use of estuarine waters for cooling purposes by steam electric generating stations, limits of habitable conditions of temperature and of the most common anti-fouling chemical, chlorine, were thus determined in sublethal terms for estuarine fishes and macroinvertebrates. Behavioral avoidance responses to temperature and to chlorine were determined under various conditions of salinity, light level, and level of dissolved oxygen over the annual range of temperatures found in the Delaware River estuary. Physiological responses in terms of metabolic rate and scope for activity were determined for different levels of salinity over the same annual range of estuarine temperatures. Since the study was multi-parameter, the data were subjected to multiple regression analysis to estimate avoidance temperatures, concentrations of chlorine which would be avoided, and active and resting metabolic rates. Acclimation (or test) temperature was found to be the dominant factor influencing the response level in all these studies. However, the effects of the other variables under study significantly affected the response as well as the effect of acclimation temperature. Further, these variables were found to interact such that the effects of the individual variables were not consistent. In several cases, these interactions were more important in determining the response level than the main effects of their components. The findings of this study thus demonstrate that laboratory studies of estuarine organisms must be multi-parameter to have ecological relevance. This is likely to be true for studies on any aquatic species. Although the results of this study can be used to estimate the environmental impact of individual thermal discharges in mid-Atlantic estuaries, they can also be used to estimate the limits of habitable conditions for each estuary as a whole. (Authors)

18887. Kerr, S. R. (Ontario Min. of Nat. Res., Fish and Wildl. Research Branch, Maple, Ontario, Canada). 1974. THEORY OF SIZE DISTRIBUTION IN ECOLOGICAL COMMUNITIES. J. Fish. Res. Board Can., 31(12): 1859-1862.

Observed regularities in the size composition of pelagic ecosystems are explained by a theoretical model based on trophic processes. The model assumes, in accord with available evidence, that prey and predator sizes are simply related, and that growth and metabolism satisfy similar functions of body (particle) size when averaged over entire trophic levels. The model appears suited to other community types that satisfy these conditions, and suggests that trophic processes are complementary to competitive displacement in determining that particle density is a linear function of the logarithm of particle size. (Auth.)

18888. Gordeyev, N. A., A. G. Poddubnyy and L. K. Il'ina (Inst. of the Biol.of Inland Waters, USSR Acad. of Sciences, Borok, Yaroslavl Province, USSR). 1974. ESTIMATION OF THE POTENTIAL FISH PRODUCTIVITY OF A RESERVOIR. J. Ichthyol., 14(1): 15-20.

Study of the potential production of Rybinsk reservoir has shown that the yield of fish cannot be more than doubled with standard fish management. It is essential to seek reserves at the expense of internal consumption in the different trophic links of the ecosystems. Analysis of the dynamics of recruitment and mortality in populations of common fishes shows that fish productivity could potentially be considerably increased given a profound knowledge of the functioning of the ecosystems.

18889. Burgess, George H., and Kerry A. MacPherson (Inst. of Mar. Sci., Univ. of North Carolina, Morehead City, N. C. 28557). 1974. NORTHERN RANGE EXTENSION OF THE PLUMED SCORPIONFISH, Scorpaena grandicornis (PISCES, SCORPAENIDAE). Chesapeake Sci., 15(3): 162-163.

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18890. Dillon, P. J., and F. H. Rigler (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1974. A TEST OF A SIMPLE NUTRIENT BUDGET MODEL PREDICTING THE PHOSPHORUS CONCENTRATION IN LAKE WATER. J. Fish. Res. Board Can., 31(11): 1771-1778.

The total phosphorus budgets for a number of lakes in the Haliburton-Kawartha region of southern Ontario were measured over a 20-mo period. These data, combined with the lakes' morphometry and water budgets, were used to test a simple nutrient budget model similar to that proposed by Vollenweider (1969) purporting to predict the total phosphorus concentration in lakes. Except in the case of two very shallow lakes ($\bar{z} < 1$ m), the concentrations predicted by the model were very close to those measured in the lakes at spring overturn. Additional data from the literature supported the belief that this model could be used effectively for oligotrophic and mesotrophic lakes. Its value lies in the fact that quantitative changes in phosphorus loading can be interpreted in terms of changes in phosphorus concentration, which in turn, can be related to changes in parameters that reflect the lake's trophic state such as summer chlorophyll a concentration. (Authors)

18891. Hakkila, K., and A. Niemi (Archipelago Research Inst., Univ. Turku, Finland). 1973. EFFECTS OF OIL AND EMULSIFIERS ON EGGS AND LARVAE OF NORTHERN PIKE (Esox lucius) IN BRACKISH WATER. Aqua Fennica, pp. 44-59; Selected Water Resources Abstracts, 8(1): p. 54.

The effects of Russian crude oil and some emulsifiers on the eggs and larvae of Northern Pike (Esox lucius) in brackish water (salinity 5.8 °/oo) were studied experimentally Neste A (emulsifier), Talestol (surfactant), crude oil dispersed with Neste A, and contact with floating oil increased the mortality of eggs during development. Dissolved fractions of oil had no effect on the mortality rate. All substances increased the occurrence of abnormal larvae. Neste A, Talestol, and dispersed oil were toxic to pike larvae; dissolved fractions, Corexit 8666, and BP 1100 had no acute effects. High temperatures increased the toxicity of emulsifiers. The resistance of pike larvae varied greatly at different stages of development.

18892. Broome, Stephen W., W. W. Woodhouse, Jr., and Ernest D. Seneca (Dept. of Soil Sci., North Carolina State Univ. at Raleigh, Raleigh, North Carolina 27607). 1974. PROPAGATION OF SMOOTH CORDGRASS, Spartina alterniflora, FROM SEED IN NORTH CAROLINA. Chesapeake Science, 15(4): 214-221.

Spartina alterniflora Loisel, produces large quantities of viable seed, particularly when stands are vigorous and relatively young. Excellent germination occurred when seeds were harvested as near the shattering stage as possible, stored in burlap sheets at 2-3 C for 1 month, and submerged in estuarine or sea water at 2-3 C until seeding the following spring. Direct seeding from April until early June is an effective method of establishing new stands of S. alterniflora on dredge spoil in protected areas. The elevation range over which seedlings can be expected to survive is limited to the upper 20-50% of that occupied by natural stands in a given area. Complete cover is achieved the first growing season and the above-ground standing crop produced from seed in one growing season can exceed that produced from transplants and may approach that of long-established marshes. (Authors)

18893. Shumway, Sandra E., and Robert R. Stickney (Div. of Natural Sciences, Southampton College, New York). 1975. NOTES ON THE BIOLOGY AND FOOD HABITS OF THE CUNNER. N. Y. Fish Game J., 22(1): 71-79.

During the summer of 1971, 500 cunners (Tautogolabrus adspersus) ranging from 61 to 200 millimeters in standard length were collected from the Sakonnet River at Portsmouth, Rhode Island. The fish were examined for meristic characters, length-weight relationships and food habits. The data indicated that the cunner is omnivorous but that the majority of its food is animal material. Various species of algae were found in the alimentary tracts examined. Balanus balanoides, Mytilus edulis and Mya arenaria dominated the food, both in occurrence and volume. Bugula sp. also contributed greatly in terms of occurrence, but it was low in volume. (Authors)

18894. Eisler, R., G. R. Gardner, R. J. Hennekey, G. LaRoche, D. F. Walsh, and P. P. Yevich (U.S. Environ. Protection Agency, Natl. Mar. Water Quality Lab., West Kingston, Rhode Island 02892). 1972. ACUTE TOXICOLOGY OF SODIUM NITRILOTRIACETIC ACID (NTA) AND NTA-CONTAINING DETERGENTS TO MARINE ORGANISMS. Reprint: Water Research, Vol. 6, pp. 1009-1027.

Static acute toxicity tests were conducted at 20°C and 20 °/oo salinity with $(CH_2\text{-}COONa)_3N \cdot H_2O$ (NTA) and two NTA-containing commercial household synthetic detergents (syndets), using adults or juveniles from eleven species of marine fishes and invertebrates. Concentrations of NTA in the medium allowing 50 percent survival of individual test species in 168 h, = TL_{50} (168 h) values, ranged between 1800 mg l^{-1} for grass shrimp, Palaemonetes vulgaris, and $>$10,000 mg l^{-1} for quahaug clam, Mercenaria mercenaria. Intermediate in sensitivity to NTA were hermit crab, Pagurus longicarpus (1875 mg l^{-1}); scup (fish), Stenotomus chrysops (2200 mg l^{-1}); common starfish, Asterias forbesi (3000 mg l^{-1}); American lobster, Homarus americanus (3150 mg l^{-1}); bay mussel, Mytilus edulis (3400 mg l^{-1}); eastern mud snail, Nassarius obsoletus (5100 mg l^{-1}); sandworm, Nereis virens (5500 mg l^{-1}); mummichog (fish), Fundulus heteroclitus (5500 mg l^{-1}); and striped bass, Roccus saxatilis (5500 mg l^{-1}). The two syndets tested were considerably more toxic than NTA to marine organisms under identical assay conditions. Fishes were the least resistant group of organisms tested to syndets; TL_{50} (168 h) values for teleosts ranged between 4.6 and 36.0 mg l^{-1} total packaged product. Histopathology was investigated for grass shrimp, hermit crab, quahaug clam, sandworm, scup, striped bass and mummichog that survived high concentrations of NTA or syndets for 168 h. Among invertebrates, pathological changes were confined to digestive diverticula and kidney of shrimp exposed to 1000 mg l^{-1} of NTA. With fishes, pathology in striped bass and mummichog was observed in proximal kidney tubules at NTA levels $>$ 3000 mg l^{-1}. However, significant intestinal lesions were noted in mummichog at NTA levels as low as 1 mg l^{-1}. No pathology was observed among fish and invertebrates subjected to syndets. The effect of biomass, water temperature and salinity on acute toxicity of NTA and syndets to mummichogs was also investigated. Increasing the biomass between 0.5 and 10.0 g l^{-1} of test medium was associated with increasing survival at any given concentration of syndet during a 48 h period; the reverse was observed for NTA. Within the salinity range 5-35 °/oo, mummichogs were most sensitive to NTA at comparatively low salinities; but syndets were most toxic at higher salinities. Water temperatures of 5° and 20°C had negligible influence on NTA- or syndet-induced mortality patterns. Mixtures of NTA and salts of cadmium or mercury were evaluated for toxicity to mummichog. An observed decrease in biocidal properties of Cd^{2+} was observed with increasing levels of NTA; concentrations as low as 10 mg l^{-1} NTA effected a measurable depression in Cd^{2+} lethality. Results of studies with NTA-Hg^{2+} mixtures were inconclusive. Tests with mixtures of syndet and Cd^{2+} or Hg^{2+} demonstrated that toxicity to mummichog of these mixtures could be expressed as a simple summation of the toxicity of individual components. It is concluded that NTA might be hazardous to marine fishes and macroinvertebrates when used as a partial replacement for sodium tripolyphosphate in household syndets. (Authors)

18895. Collins, J. J., and A. O. Dechtiar (Ont. Min. of Nat. Resources, Fish and Wildl. Res. Branch, South Bay Fisheries Res. Sta., Tehkummah, Ontario, Canada). 1974. PARASITE FAUNA OF KOKANEE SALMON (Oncorhynchus nerka) INTRODUCED INTO LAKE HURON. J. Fish. Res. Board Can., 31(11): 1818-1821.

In a 7-yr study, the most common parasites of kokanee salmon (Oncorhynchus nerka) introduced to Lake Huron were the acanthocephalans Metechinorhynchus salmonis (in 61% of 228 adult fish examined) and Acanthocephalus jacksoni (15%) and the nematode Cystidicola stigmatura (41%). These also occurred in fish species netted along with kokanee, but many common parasites of other salmonids in Lake Huron were not harbored by kokanee. In addition to evidence of attack by sea lamprey (Petromyzon marinus), 18 species of parasites were found, 13 of which had not been previously recorded for kokanee in the Pacific drainages of North America. The high incidence of M. salmonis and C. stigmatura indicates that amphipods are commonly ingested by kokanee. (Authors)

18896. Eaton, John G. (U.S. Environ. Protection Agency, Natl. Water Quality Lab., 6201 Congdon Blvd., Duluth, Minnesota 55804). 1974. CHRONIC CADMIUM TOXICITY TO THE BLUEGILL (Lepomis macrochirus Rafinesque). Trans. Amer. Fish. Soc., 103(4): 729-735.

Nine out of 18 adult bluegills exposed for 11 months during a chronic bioassay including reproduction were killed at 80 μg/liter of cadmium in water of 200 mg/liter (as $CaCO_3$) hardness. Progeny exposed for 30 days were killed at 90 μg/liter. Adult fish spawned at 239 μg/liter and at 2,140 μg/liter, but most larvae were severely crippled 6 days after hatching at these concentrations. No effects on survival, development, or reproduction were attributable to cadmium at 31 μg/liter. The highest tissue residues were found in liver, intestine and caecum, and kidney. Cadmium concentrations increased with exposure concentration in gill, liver, and intestine and caecum, but not in kidney. At least until more information is available on cadmium toxicity in different water types, chronically toxic and "just safe" continuous exposure concentrations probably can be estimated better by relatively short-term exposures of embryos and larvae than by the use of application factors. (Auth.)

18897. Schultz, D. P. (Southeastern Fish Control Lab., Warm Springs, Georgia). 1972. RESIDUES OF 2,4-D IN WATER, HYDROSOL, AND THREE SPECIES OF FISH. Abstracts of the 1972 Meeting of the Weed Science Soc. of America, pp. 12-13; Weed Abstracts, 23(8): p. 181, 1974.

In studies designed to determine the uptake, metabolism and dissipation of the dimethylamine salt of ring-labelled ^{14}C-2,4-D, channel catfish, bluegills and largemouth bass were exposed to 0.5, 1 or 2 ppm of 2,4-D in plastic pools for up to 12 weeks. Samples of fish, water and hydrosol were removed and analysed for 2,4-D content 1-84 days after treatment. The highest concn. of 2,4-D in water after 35 days was 0.05 ppm but less than 0.01 ppm was detected by 84 days regardless of treatment level. The highest 2,4-D residue level in hydrosol was 0.21 ppm 7 days after treatment with 2 ppm. The highest residue levels found in the pools after 14, 21, 35, 49, 63 and 84 days were 0.13, 0.07, 0.06, 0.03, 0.01 and 0.02 ppm respectively. After 84 days 2 pools had residues of 0.02 ppm while the remainder contained < 0.01. Edible portions of fish exposed to 2 ppm of 2,4-D contained less than 0.05 ppm of 2,4-D after 84 days.

18898. Miettinen, V., E. Blankenstein, K. Rissanen, M. Tillander, and J. K. Miettinen (Dept. of Radiochem., Helsinki Univ., Finland). 1970. PRELIMINARY STUDY ON THE DISTRIBUTION AND EFFECTS OF TWO CHEMICAL FORMS OF METHYLMERCURY IN PIKE AND RAINBOW TROUT. Presented at: FAO Tech. Conf. on Mar. Pollution and Its Effects on Living Resources and Fishing, Rome, Italy, 9-18, 12 p.; Selected Water Resources Abstracts, 8(4): p. 52, 1975.

In Scandinavia and the U.S.A. the highest mercury concentrations of all fish species are reported in pike. Therefore, preliminary toxicity determinations of methylmercury on pike and on a salmonoid (rainbow trout) were carried out. Salmonoids usually are most sensitive to heavy metal poisoning. The specific purposes of the experiments were to determine whether methylmercury is more toxic in the free ionic form than when bound to SH-groups of proteins, as it is in the food chain in nature; to determine the approximate dose of methylmercury that is lethal to pike and rainbow trout; and to find the pathological changes and the gross distribution of labelled methylmercury in the fish. No detectable difference was found between the toxicity of the ionic and protein-bound forms of methylmercury to pike and rainbow trout. With fast dosing, the LD 50/30d value is approximately 15 mg Hg/kg for both species. This evidently is less than the fish could tolerate for months or years of chronic intake. The fish were able to defend themselves against the intake of the poison; of the ionic form about 50%, and of the protein-bound form, 75% was vomited immediately after administration. For what remained absorbed after the first day, an approximate biological half-time of 110 plus or minus 20 days was obtained.

18899. Collins, M. T., et al. (Dept. of Med. Microbiol., College of Vet. Med., Univ. of Georgia, Athens, Georgia). 1974. CHEMICAL AND BACTERIAL WATER QUALITY CHANGES IN AQUATIC LIFE SUPPORT SYSTEMS. Proc. 55th Conf. Res. Workers Animal Dis.; Fish Health News, 4(1): p. 15.

The objective of this study was to monitor the water quality changes in a recirculating aquatic life support system. Channel catfish fingerlings were maintained in 20-gallon aquaria each equipped with a recirculating filter containing quartz gravel as a filter matrix. Standard methods were employed to monitor bacterial flora and chemical water quality parameters. Establishment of nitrification took 30 days. During this time a rapid rise and fall of ammonia and nitrite concentrations occurred successively. Nitrite concentrations reached toxic levels (2.5 ppm) resulting in 100% mortality of fish. Nitrate concentrations rose steadily after nitrification had become established. Total bacterial counts rose steadily to approximately 10^7 organisms per ml. The Aeromonas and lactose positive bacterial counts were approximately 10^4 organisms per ml except when the nitrite concentrations were elevated. At that time both Aeromonas and lactose positive organisms were too few to count. After establishment of nitrification, channel catfish were successfully maintained in the recirculating systems in good health without major changes in the water quality. (Authors)

18900. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA, 78850 Thiverval-Grignon, France). 1974. ON MEASURES OF PREVENTION OF TROUBLES DESIGNATED UNDER THE NAME "MYCOSIC SYNDROME" IN PISCICULTURE. (Sur les Mesures de Prevention des Troubles Designes sous l'Appellation "Syndrome Mycosique" en Pisciculture). Bull. Fr. Piscic., 254(3): 9-10, Technical Note No. 1, in French.

18901. Loyacano, Harold A., Jr., and Richard B. Grosvenor (Clemson Univ., Clemson, South Carolina 29631). 1974. EFFECTS OF CHINESE WATERCHESTNUT IN FLOATING RAFTS ON PRODUCTION OF CHANNEL CATFISH IN PLASTIC POOLS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, 470-473.

Chinese waterchestnut was grown in rafts floating on catfish pools to determine effects on production of channel catfish fed daily. This plant may remove nutrients from the water and increase catfish production by improving water quality and, also, produce a second crop, the edible corm of the plant. Catfish were stocked in March, Chinese waterchestnuts were planted in April, and both were harvested in October. Survival and production of fish were 56% and 1230 kg/ha, 86% and 1871 kg/ha, and 87% and 1952 kg/ha in pools with fish only, fish and raft, and fish and raft with waterchestnut, respectively. (Authors)

18902. Tait, Howard D. (Great Lakes Fish. Lab., U. S. Fish & Wildl. Serv., Dept. of the Interior, Ann Arbor, Michigan 48107). 1973. FEDERAL GREAT LAKES FISHERY RESEARCH OBJECTIVES, PRIORITIES, AND PROJECTS. Reprint from: Proc. First Fed. Conf. Great Lakes, U.S. Interagency Comm. Mar. Sci. Eng., (Tudor T. Davies, Ed.), pp. 44-47.

Fishery productivity of the Great Lakes has declined drastically since settlement of the area. Premium quality fishes of the Great Lakes such as whitefish, lake trout, and walleyes have been replaced by less desired species. The change is attributed to selective overfishing, pollution, and the extreme instability of fish populations. Sea lamprey predation is still a vexing problem but progress is being made in controlling this parasite. The federal fishery research program with headquarters in Ann Arbor, Michigan, has the objective of providing baseline information, needed in resource use decisions, about the fishes of the Great Lakes. Studies of the habitat requirements of fish are high priority. The program includes fish population assessments, studies of the effects of mercury and other contaminants on fish, thermal effects studies, and general investigation of the impact of engineering projects on Great Lakes fisheries. The work is closely coordinated with state and Canadian agencies through the Great Lakes Fishery Commission. Four small research vessels and four field stations are utilized with a staff of 90 and an annual budget of about $1.5 million. (Auth.)

18903. Bull, Christopher J., and John E. McInerney (Dept. of Recreation and Conservation, Fish & Wildl. Branch, Victoria, British Columbia, Canada). 1974. BEHAVIOR OF JUVENILE COHO SALMON (Oncorhynchus kisutch) EXPOSED TO SUMITHION (FENITROTHION), AS ORGANOPHOSPHATE INSECTICIDE. J. Fish. Res. Board Can., 31(12): 1867-1872.

Wild underyearling coho salmon, Oncorhynchus kisutch, in a stream aquarium were exposed to sublethal concentrations of the organophosphate insecticide Sumithion (0.10, 0.23, 0.48, and 0.75 ppm fenitrothion). After 2-h exposure at 0.48 and 0.75 ppm the pattern of behavior changes indicated physiological impairment. All behaviors involving locomotion, including some comfort behaviors, virtually ceased. Many fish, unable to maintain position, were swept downstream. Only coughing increased in frequency with insecticide concentration, providing an indicator of physiological stress. In the 0-0.23 ppm range social behaviors and feeding markedly decreased in frequency whereas comfort movements generally increased; feeding was depressed at concentrations as low as 0.1 ppm. Of the various behaviors examined, feeding probably provides the best combination of a sensitive indicator of low level contamination by an organophosphate insecticide and a behavior with important ecological implications. (Authors)

18904. Tokarev, A. S. (State Planning and Design Inst. of the Fishing Fleet (Giprorybflot), Leningrad, USSR). 1974. DETERMINATION OF THE PERMISSIBLE ANNUAL FISH CATCH FOR LONG-TERM PLANNING PURPOSES. J. Ichthyol., 14(1): 60-67.

Consideration is given to aspects of the quantitative estimation of the limitation of catches from the point of view of preserving natural resources in the long-term planning of the development of the fishing industry. Graham's model of a population was taken as the starting point for the construction of expressions relating the size of the fish catch to the rate of exploitation.

18905. Skea, Jack C., Howard J. Dean, Clifford Talbot, and Charles N. Frisa. 1975. TOXICITY OF TWO SYNTHETIC PYRETHRINS TO BROWN TROUT. N. Y. Fish Game J., 22(1): 62-67.

The toxicity of two synthetic pyrethrins, SBP 1382 EC (24.3 percent active ingredient) and Formula 7067 (5 percent active ingredient) was determined for fingerling brown trout. By bioassay, it was found that the 24-hour TL_m for SBP 1382 EC was approximately 1.2 micrograms per liter and that the 24-hour and 48-hour TL_m for Formula 7067 were 4.9 and 3.5 micrograms per liter, respectively. Data also indicated that there was a breakdown of SBP 1382 EC when mixed with acetone in stock solutions and kept for more than 24 hours. (Authors)

18906. Parker, Nick C., and Bill A. Simco (Dept. of Biol., Memphis State Univ., Memphis, Tennessee 38152). 1974. EVALUATION OF RECIRCULATING SYSTEMS FOR THE CULTURE OF CHANNEL CATFISH. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 474-487.

Channel catfish can be cultured at high densities in carefully managed recirculating raceway systems. Various flow rates, exchange rates, and tank to filter ratios were investigated in ten recirculating systems employing biological filters, settling chambers and foam strippers. Limestone, shells, styrofoam and teflon rings served as effective filter media, but coal slag restricted water flow and was not satisfactory. An equation was developed to evaluate the effects of system design on water quality. Water quality varies directly with fresh water exchange, flow rate per tank, and the filter size. Production was greater in systems with small tanks and large filters (5 lb/ft^3) than in systems with large tanks and small filters (1 lb/ft^3). Densities in excess of 7 lb/ft^3 per tank have been obtained, indicating recirculating systems may become an increasingly important method of fish culture. (Authors)

18907. Nebeker, Alan V., and Frank A. Puglisi (U.S. Environ Protection Agency, Natl. Water Qual. Lab., Duluth, Minnesota 55804). 1974. EFFECT OF POLYCHLORINATED BIPHENYLS (PCB'S) ON SURVIVAL AND REPRODUCTION OF Daphnia, Gammarus, AND Tanytarsus. Trans. Amer. Fish. Soc., 103(4): 722-728.

18908. Marking, Leif L. (Fish Control Lab., P. O. Box 862, La Crosse, Wisconsin 54601). 1974. TOXICITY OF 2-(DIGERANYLAMINO)-ETHANOL, A CANDIDATE SELECTIVE FISH TOXICANT. Reprint: Trans. Amer. Fish. Soc., 103(4): 736-742.

The chemical, 2-(digeranylamino)-ethanol, was tested in the laboratory and in outdoor plastic pools to determine the toxicity to a variety of cold- and warmwater fish. An interesting aspect is that the toxicant is more toxic to carp (Cyprinus carpio) than to other warmwater fish. The 96-hr LC50 (concentration producing 50% mortality) for carp is 0.0507 mg/liter, whereas that value for centrarchids ranges from 0.237 mg/liter for smallmouth bass (Micropterus dolomieui) to 0.720 mg/liter for bluegill (Lepomis macrochirus). The toxicant is significantly less toxic (P = 0.05) to bluegill in cold water (12 C) than in warmer water (17 and 22 C), and it is more toxic in hard water than in soft water. Toxicity tests with green sunfish (Lepomis cyanellus) show that the toxicant is significantly more toxic (P - 0.05) in high pH water (pH = 9.0) than in low pH water (pH - 6.0), and the toxicant detoxifies at a faster rate in pH 9 than in lower pH water. Some aquatic invertebrates are more resistant than fish to the toxicant. The chemical is a good candidate selective toxicant, but additional studies are needed to support a registration for its use. (Auth.)

18909. Kjelson, Martin A., David S. Peters, Gordon W. Thayer, and George N. Johnson (Atlantic Estuarine Fish. Center, NMFS, NOAA, Beaufort, North Carolina 28516). 1975. THE GENERAL FEEDING ECOLOGY OF POSTLARVAL FISHES IN THE NEWPORT RIVER ESTUARY. NOAA Fish. Bull., 73(1): 137-144.

Food preferences, feeding intensity and chronology, evacuation rates, and daily rations were determined for postlarval stages of Atlantic menhaden, Brevoortia tyrannus (25-32 mm); pinfish, Lagodon rhomboides (16-20 mm); and spot, Leiostomus xanthurus (17-24 mm). Four copepod taxa, Centropages, Temora, Acartia, and Harpacticoida, made up 76-99% of the total gut contents. Postlarval feeding intensity was greatest during early daylight hours. Postlarval menhaden lost an estimated 60% of their original gut contents due to the stress of handling and capture. Similar stress caused no food loss in either postlarval pinfish or spot. Gastrointestinal evacuation of copepods and Artemia nauplii were described by linear regression. Evacuation rates varied directly with the amount of food in the gut. Rate constants were used in conjunction with information on the chronology of gut contents to determine daily rations. Daily ration estimates as a percent of the fish's wet body weight were: menhaden, 4.9%; pinfish, 3.5%, spot, 4.3% and 9.0%. The ration estimates for spot in terms of calories per fish per day were similar to the metabolic needs estimated from oxygen consumption measurements but were lower than the estimates from oxygen consumption for menhaden and pinfish. (Authors)

18910. Anonymous. 1974. MOLYBDENUM AND FISH. Industrial Water Engineering, 11(3): p. 6; Selected Water Resources Abstracts, 8(1): p. 52.

Results of extensive tests to determine the effects of water-soluble molybdenum on several varieties of fish have been announced. The fish species tested were bluegill, rainbow trout, fathead minnows, and channel catfish. The amount of active ingredient toxic to 50 percent of the specimens for all species ranged from 6500 to greater than 10,000 ppm, the highest concentration tested. The level at which no adverse symptoms were observed varied from 2400 ppm for bluegill to 7500 ppm for channel catfish.

18911. Diener, Richard A., Anthony Inglis, and Genevieve B. Adams (Natl. Mar. Fish. Serv., Gulf Coastal Fish. Center, Galveston Lab., Galveston, Texas 77550). 1974. STOMACH CONTENTS OF FISHES FROM CLEAR LAKE AND TRIBUTARY WATERS, A TEXAS ESTUARINE AREA. Contributions in Marine Science, Vol. 18, pp. 7-17.

Stomach contents were analyzed from 5,019 bony fishes, representing 40 species, caught during 1958 by trawl in the Clear Lake area, a secondary bay system located on the west side of upper Galveston Bay, Texas. The most frequently observed items included polychaete annelids, copepods, mysidaceans, penaeid shrimp, river shrimp (Macrobrachium sp.), grass shrimp (Palaemonetes sp.), plant debris, organic detritus, mud, and sand. (Authors)

18912. Hodson, Peter V., and John B. Sprague (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1975. TEMPERATURE-INDUCED CHANGES IN ACUTE TOXICITY OF ZINC TO ATLANTIC SALMON (Salmo salar). J. Fish. Res. Board Can., 32(1): 1-10.

Three groups of Atlantic salmon (Salmo salar) parr were acclimated to water temperatures of 3, 11, and 19 C. When exposed at their acclimation temperature to lethal concentrations of zinc, cold-acclimated salmon survived longer than warm-acclimated salmon. However, the threshold lethal concentration (LC50) of zinc was highest for salmon at 19 C, i.e. there was less toxicity at the high temperature. At test temperatures lower than prior acclimation temperatures, survival times in zinc were longer but the threshold LC50 was lower, i.e. fish were less tolerant of zinc. The opposite results were seen at temperatures above prior acclimation temperatures. The threshold LC50 may be predicted by the equation $LC50 = 1.9611 - 0.1873\ Ta + 0.8699\ Te - 0.0414\ Te^2 + 0.00004\ Ta\ Te^3$, where Ta = temperature of acclimation and Te = temperature of exposure. In polluted rivers, zinc concentrations may be most damaging to fish populations during the winter months. Measured concentrations of zinc and copper in the Miramichi River, New Brunswick were highest in winter when estimated toxicity of metal was also greatest. (Authors)

18913. Grygierek, Eugenia (Inst. Rybactwa Srodladowego w Olsztynie, Zaklad Gospodarki Stawowej Zabieniec, kolo Warszawy, Poland). 1973. ZOOPLANKTON IN NURSERY PONDS. (Zooplankton w przesadkach I). Roczniki Nauk Rolniczych, 95(3): 7-34. In Polish with English summ.

Investigations were conducted furing five years in a dozen or so nursery fish ponds situated in a close vicinity each other and utilized for a period from late May until early July. Two ponds remained unfertilized during the experimental period while the other ones were treated with nitrogen fertilizers in quantities equivalent to 210 kgs N per hectare and with superphosphate in a quantity of 50 kgs P_2O_5 per hectare. The nursery ponds were stocked with carp hatch numbering some 125,000 per hectare. Zooplankton samples were collected irregularly during the experimental period. The dynamics of the number and biomass as well as of the numerical proportions between crustacean species from the ponds utilized alike during consecutive years were found to be highly variable. It was stated as well a considerable differences between the ponds treated alike in the same year. A relation was observed between the number of fish and Bosmina longirostris, the species typical for fish feeding ground, and the temperature. It was corroborated by the differences between the coastal and central parts of a pond. An analysis of the permeability effect upon the growth of zooplankton was performed. Pond fertilization was not found to bear effect upon the number, biomass and qualitative relations between the species examined. The reason for this was found to be an acknowledged intensity of fish feeding with an increased food quantity. The differences in the intensity of fish feeding and zooplankton production in both fertilized and unfertilized ponds as well as a quicker exchange of biomass in the unfertilized ponds allow for considering that fertilization has a beneficial effect upon zooplankton, and especially upon the rotifers being organisms eaten up by fish in minute quantities. -- T. Gronkiewicz

18914. Hill, Thomas K., J. L. Cheness, and E. E. Brown. 1974. GROWING CHANNEL CATFISH, Ictalurus punctatus (Rafinesque), IN RACEWAYS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 488-499.

Techniques were investigated for growing channel catfish, Ictalurus punctatus (Rafinesque), from fingerlings to harvestable size fish during the summer months in a recirculation, flowing water fish culture system in South Georgia. When stocked at a density of 2,000 fingerlings per 100 ft raceway unit, mean production was more than 2,400 lb per unit with a feed conversion ratio of 1.28 to 1. Survival of the fish was 98.1%. Successful culture of 2,400 fish in one unit indicated that the carrying capacity of the raceways used in this study was greater than 2,000 fish. There was a gradual deterioration of water quality as it flowed through the raceways but, none of the water quality parameters measured were considered detrimental to the fish. Infestations of Cleidodiscus, Scyphidia and Trichodina were controlled by adding formalin to the water in the raceways at the rate of 30 ppm with the water flow stopped for 1 hr. (Authors)

18915. McBride, J. R., and A. P. van Overbeeke (Dept. of theEnviron., Fish. and Mar. Serv., Vancouver Lab., Vancouver, British Columbia V6T 1X2). 1975. EFFECTS OF THIOUREA TREATMENT ON SEXUALLY MATURING AND GONADECTOMIZED MALE SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Board Can., 32(1): 11-19.

Adult male sockeye salmon in the final stage of sexual maturation were treated with thiourea for periods of 7-14 wk. The treatment produced strong histological thyroid stimulation but no visible effect on spermatogenesis or development of secondary sexual characteristics. The drug did not affect the interrenal hypertrophy that commonly occurs in these salmon, but slightly inhibited the increase in thickness of the skin. Thiourea induced changes in the pars distalis of the pituitary gland, involving several cell-types, including retardation of gonadotrop development. In gonadectomized fish, thiourea affected neither the skin, nor the interrenal tissue. It caused a marked increase in the height of the thyroid epithelium, correlated with hypertrophy, degranulation, and some vacuolization of PAS-positive cells in the dorso-caudal area of the proximal pars distalis of the pituitary gland. Therefore, these last cells are considered thyrotrops. (Authors)

18916. Dorson, M. Michel (Inst. Natl. de la Recherche Agronomique, Laboratoire d'Ichtyopathologie, route de Thiverval, 78850 Thiverval-Grignon, France). 1974. PRECIPITATING ANTIBODY AGAINST DNP-HEMOCYANIN PRODUCED IN RAINBOW TROUT FRY IMMUNIZED AT THE AGE OF ONE MONTH. (Production d'anticorps precipitants anti-dinitrophenol chez les alevins de truite Arc-en-Ciel (Salmo gairdneri) immunises a l'age d'un mois). C. R. Acad. Sc. Paris 278 (D): 3151-3152; Fish Health News, 4(1): p. 16.

Rainbow trout averaging 0.15 g were injected with a standardized, conjugated antigen used in immunological studies, DNP Keyhole Limpet hemocyanin emulsified with Freund's complete adjuvant. Three months later, specific precipitating antibody was detected in the serums of 10 out of 28 injected fish. This study indicates the trout are immunocompetent when they begin to feed. -- D. P. Anderson

18917. Aliev, D. S., A. I. Sukhanova, and R. E. Muravleva. 1973. BIOLOGICAL BASES FOR THE FARMING OF HERBIVOROUS FISH AND THEIR USE FOR BIOLOGICAL WEED CONTROL. In: Itogi Issledovanii po Mezhdunarodnoĭ Biologicheskoĭ Programme (1966-70). Otdelenie Biologicheskikh Nauk, Akademiya Nauk Turkmenskoĭ SSR: edited by N. T. Nechaeva et al. Ashkhabad, Ylym, 102-110; Weed Abstracts, 23(9), abstract 1854, 1974.

Prolific weed growth reduced the carrying capacity of the Karakum canal in the Turkmenian SSR by as much as 75%. Grass carp (Ctenopharyngodon idella) was introduced in 1958-61 to control weeds. The fish reproduced naturally and multiplied and have kept the 850 km long canal weed-free up to the present. Trials in 1966-71 showed that grass carp can be used to control weeds in drainage canals with salinities $<$11-12 parts per thousand. The fish (average wt. 20-30 g) are stocked in March-April at 120-150/ha. Herbivorous fish now make up 15% of the marketable freshwater fish in the USSR and $>$ 50% in some of the southern regions of the country.

18918. Powers, Joseph E. (Dept. of Fish., School of Nat. Resources, California State Univ., Humboldt, Arcata, California 95521). 1974. COMPETITION FOR FOOD: AN EVALUATION OF IVLEV'S MODEL. Trans. Amer. Fish. Soc., 103(4): 772-776.

Ivlev's model of competition for food is evaluated. This model expresses ration size as a function of prey density and population size. Ivlev's model is elaborated upon by including a term concerning the size (weight) of the animal. Alternative ways in which the effect of population size upon intraspecific competition may be described are suggested. Ivlev's model and two alternatives are fit to data from an amphipod population by nonlinear regression. Results suggest that intraspecific competition affects the efficiency with which the consumer captures its food, rather than affecting the maximum amount it is capable of eating. This approach is generalized to include both intra- and interspecific competition for food. (Auth.)

18919. Perry, W. Guthrie, Jr., and James W. Avault, Jr. (Louisiana Wild Life and Fish. Comm., Grand Chenier, Louisiana 70643). 1974. INFLUENCE OF FLOATING AND SINKING FEEDS AND FINGERLING SIZE ON CHANNEL CATFISH PRODUCTIONS. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 500-511.

A comparison was made with a floating and sinking ration of similar analysis produced by the same manufacturer. This study demonstrated an increase in catfish production when using the sinking ration. Moreover, the sinking feed produced catfish of a larger averate size, a better food conversion, and a smaller Ktl factor. Use of sinking feed represented a savings of approximately $54 to $72 per acre on the feed bill. Data were compared for the influence of fingerlings size at stocking (4.5, 6.5 and 8 inch) upon catfish production. The larger fingerlings experienced larger S-factors; however, the high percent of harvestable size justified using this size fish for one year's production. (Authors)

18920. Berrien, Peter L. (Middle Atlantic Coastal Fish. Center, Sandy Hook Lab., NMFS, NOAA, P. O. Box 428, Highlands, New Jersey 07732). 1975. A DESCRIPTION OF ATLANTIC MACKEREL, Scomber scombrus, EGGS AND EARLY LARVAE. NOAA Fish. Bull., 73(1): 186-192.

The development of laboratory-reared Atlantic mackerel, Scomber scombrus, eggs and early larvae is described in order to augment published descriptions of this species. The eggs are spherical, have a diameter of 1.01 to 1.28 mm, and have a single, yellowish oil globule, 0.22 to 0.38 mm in diameter. Melanophores, first visible after blastopore closure, assume a distinct pattern on the embryo. Melanophores are present on the oil globule but are absent from the yolk surface except immediately prior to hatching. Hatching occurs at 90 to 102 h after fertilization at an average incubation temperature of 13.8°C. Bodily pigmentation of the larvae undergoes considerable change during yolk absorption; eye pigmentation is apparent at 66 h after hatching. The yolk is fully absorbed by 137 h after hatching, and teeth are present in 192-h-old larvae. (Auth.)

18921. Godin, J.-G., P. A. Dill, and D. E. Drury (Dept. of Biol., St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada). 1974. EFFECTS OF THYROID HORMONES ON BEHAVIOR OF YEARLING ATLANTIC SALMON (Salmo salar). J. Fish. Res. Board Can., 31(11): 1787-1790.

Swimming activity, aggressive behavior, and upstream orientation of yearling Atlantic salmon (Salmo salar) treated with 6.43×10^{-11} m thyroxine were significantly lower than those of control fish injected with solvent alone. Two concentrations of triiodothyronine (7.43×10^{-11} m; 7.43×10^{-10} m) caused similar but less pronounced effects. Because similar behavioral modifications accompany smolt migration, we hypothesize that thyroid hormones may play a role in arousing migratory tendencies in Atlantic salmon. (Authors)

18922. Wellborn, Thomas L., Jr., and James Harry Barkley (Ext. Wildl. and Fish., Drawer LW, Mississippi State Univ., State College, Mississippi 39762). 1974. STUDY ON THE SURVIVAL OF TOURNAMENT RELEASED BASS ON ROSS R. BARNETT RESERVOIR, APRIL 1973. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 512-519.

The survival of bass (Micropterus spp.) caught and released during the Rebel Invitational B.A.S.S. Tournament on Ross R. Barnett Reservoir, Mississippi, April 4-6, 1973 was studied. Two different techniques for handling the bass prior to release were evaluated. A total of 1,863 bass were caught by 159 fishermen during the tournament. Of these, 197 (10.57%) were judged to be dead at the weigh-in. The remaining 1,666 bass were randomly divided into two groups for treatment or non-treatment. A total of 830 bass were injected IP with oxytetracycline and marked prior to release into a 0.8 hectare blocked-off area. The 836 non-treated bass were handled in the same manner except they were not injected or marked prior to release into the study area. A significantly higher number of treated bass (96.99%) survived the 19 day study period than did the non-treated bass (91.63%). It was observed that four interrelated factors play a role in determining survival rate of tournament released bass. (Authors)

18923. Armstrong, F. A. J., and D. P. Scott (Dept. of the Environ., Fish. and Mar. Serv., Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1974. PHOTOCHEMICAL DECHLORINATION OF WATER SUPPLY FOR FISH TANKS, WITH COMMERCIAL WATER STERILIZERS. J. Fish. Res. Board Can., 31(12): 1881-1885.

Commercial mercury-lamp water sterilizers can be used for removal of free chlorine in water supplies, by photochemical action. The efficiency of removal decreases with increasing pH, but is little affected by temperature. It is greatest at low initial chlorine concentration. Equipment with either low or high pressure mercury vapor lamps may be used. Removal of 90% of free chlorine can be effected at about 13.0 liters min^{-1} with a sterilizer using eight low pressure lamps of 40 W, or at 50 liters min^{-1} or more with two 1200-W sterilizers with high pressure lamps in tandem. Treated water appears to be harmless to fish. (Authors)

18924. Copeland, B. J., and Timothy J. Bechtel (Dept. of Zool., North Carolina State Univ., Raleigh, North Carolina 27607). 1974. SOME ENVIRONMENTAL LIMITS OF SIX GULF COAST ESTUARINE ORGANISMS. Contributions in Marine Science, Vol. 18, pp. 169-204.

Literature and data analyses of six sports and commercially important species occupying Gulf coast estuaries were made utilizing a computerized sorting technique. Data relating to catch versus environmental characteristics were collated from literature references and the data files of several state and federal laboratories. Catch ratios, reflecting catches above a threshold value, were computed and sorted into temperature, salinity, seasonal and location classes and into various interaction categories. Gross temperature, salinity, location and season ranges and optima were established for menhaden (Brevoortia patronus), sand trout (Cynoscion arenarius), blue crabs (Callinectes sapidus), white shrimp (Penaeus setiferus), pink shrimp (Penaeus duorarum) and brown shrimp (Penaeus aztecus). Analyses of interactions among the environmental variables verified several conclusions from single factor analyses, but also delineated many details of habitat, migration and estuarine utilization. The technique developed is considered to be capable of describing outside limits and providing management criteria for estuarine programs. (Authors)

18925. Hart, Larry G., and Robert C. Summerfelt (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma 74074). 1974. HOMING BEHAVIOR OF FLATHEAD CATFISH, Pylodictis olivaris (Rafinesque), TAGGED WITH ULTRASONIC TRANSMITTERS. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 520-531.

Homing behavior of flathead catfish in an Oklahoma reservoir was observed by tracking fish bearing a 74 kHz transmitter which had been implanted in the peritoneal cavity. Homing is described from 1,190 fixes (site locations) obtained on 22 flathead catfish. The average tracking interval was 18.7 days. Homing occurred in 8 of 12 (67%) fish displaced a distance of 1.3-2.7 km from the site of capture. Average accuracy of homing fish was within 182 m of the original site of capture. One transmitter tagged fish, displaced 1.82 km, returned to the site of capture within 1.7 days. All 12 displaced fish, regardless of whether or not they homed, moved away from their release site before establishing a home range. Most (70%) of the non-displaced fish remained in a well-defined area near the site of release (i.e., the original site of capture) which also provided evidence that the fish recognized a home area. Only 4 of 18 displaced catfish marked with butt-end and anchor tags (i.e., without transmitters) were recaptured, none exhibited homing. (Authors)

18926. Reimer, Rollin D., and Douglas B. Jester (Dept. of Wildl. and Fish. Sci., Texas A&M Univ., College Station, Texas 77843). 1975. A NEW CRAWFISH OF THE GENUS Orconectes FROM CONCHAS LAKE, NEW MEXICO. Tulane Studies in Zoology and Botany, 19(1 - 2): 17-21.

Orconectes deanae is described from Conchas Lake, South Canadian River drainage, in San Miguel County, New Mexico. It is most closely related to members of the Palmeri Group of the Virilis Section. (Authors)

18927. Lavoie, M., and L. G. Mathieu (Dept. de microbiol. et d'immunologie Faculte de medecine, Univ. de Montreal, C.P. 6128, Montreal 101, Quebec, Canada). 1974. INCIDENCE OF HEMOLYTIC AND R FACTORS IN LACTOSE-FERMENTING ENTERIC BACTERIA ISOLATED FROM THE DIGESTIVE TRACT OF FISH. Revue Canadienne de Biologie, 33(3): 185-191.

The detection in fish microflora of antibiotic resistance (R) factors with patterns of drug resistance similar to those of R factors found in human Enterobacteriaceae and transferable to Escherichia coli by conjugation has already been reported and it adds a new dimension to the problem of public health hazards related to antibiotic resistance. In the present work we have observed that nearly 9% of a group of bacteria first isolated as lactose-fermenting enteric (LFE) organisms from fish caught in the St. Lawrence River downstream of Montreal exhibited some form of resistance to antibiotics of current usage in human and veterinary medicine. Since the bacterial flora of fish is known often to reflect their aquatic environment, this percentage should not be extrapolated, but viewed only as evidence that in our sewage polluted waters fish may harbor antibiotic resistant LFE bacteria. Transfer by conjugation of some of these resistance factors to Salmonella typhimurium LT-2 and E. coli K-12, F–, Lac– was successful with many of these insolates. It was also possible to effect the transfer of R factors from S. typhimurium LT-2 to Aeromonas hydrophila a bacterium related to coliforms and a member of the fish bacterial flora. There was no correlation between the species of fish and the frequency of any of the properties of the LFE bacteria studied. Approximately 3 percent of the isolates were hemolytic, while a large proportion exhibited a lesser sensitivity than control E. coli strains to copper and cobalt but not to mercury ions. Antibiotic resistance did not appear to be linked to this apparent tolerance to the two heavy metals. The finding in the digestive tract of fish of LFE bacteria carrying R factors with conjugal transferability to S. typhimurium LT-2 and to E. coli strains and the possibility that at least the former species can transfer R-factors to fish indigenous flora add a dimension to the problem of the reservoirs, vectors and sites of propagation of these factors in relation with public health. (Authors)

18928. Groot, C., K. Simpson, I. Todd, P. D. Murray, and G. A. Buxton (Dept. of the Environ., Fish. and Mar. Serv., Pacific Biol. Sta., Nanaimo, British Columbia V9R 5K6, Canada). 1975. MOVEMENTS OF SOCKEYE SALMON (Oncorhynchus nerka) IN THE SKEENA RIVER ESTUARY AS REVEALED BY ULTRASONIC TRACKING. J. Fish. Res. Board Can., 32(2): 233-242.

Movements of adult sockeye salmon (Oncorhynchus nerka) entering the Skeena River were examined in 1969 and 1970 by ultrasonic tracking methods. Fifteen of 18 sockeye released in the lower river seemed to move passively in and out with flood and ebb streams. Two fish moved upstream independent of tides and one salmon swam against ebb and flood currents. Ground speeds in both years of operation were 1.6 km/h during rising and 2.1 km/h during falling tides, causing the fish to be transported downstream by about 3 km per tidal cycle. Three salmon released outside the river mouth in salt water also seemed to ride the tidal flows passively. Ground speeds during ebb (3.6 km/h) were again greater than during flood (2.0 km/h), indicating a net offshore movement. We conclude that these passive movements are not an artifact but that sockeye salmon normally slow down or pause upon reaching the "home river" and drift for a period in tidal currents in the estuary and river mouth before migrating upstream. (Authors)

18929. Rice, Stanley D., and Robert M. Stokes (Dept. of Biol. Sci., Kent State Univ., Kent, Ohio 44242). 1975. ACUTE TOXICITY OF AMMONIA TO SEVERAL DEVELOPMENTAL STAGES OF RAINBOW TROUT, Salmo gairdneri. NOAA Fish. Bull., 73(1): 207-218.

Median tolerance limits derived from 24-h bioassays demonstrated that fertilized eggs and alevins of rainbow trout, Salmo gairdneri, were not vulnerable to 3.58 ppm un-ionized ammonia at 10°C (pH 8.3). At the end of yolk absorption, rainbow trout fry increased in susceptibility dramatically; their median tolerance limit values were about 0.072 ppm, the same as for adult trout. Fertilization of eggs was not prevented in un-ionized ammonia solutions up to 1.79 ppm, the highest exposure tested. (Authors)

18930. Richardson, Nancy E., and James D. McCleave (Dept. of Zool., Univ. of Maine, Orono, Maine 04473). 1974. LOCOMOTOR ACTIVITY RHYTHMS OF JUVENILE ATLANTIC SALMON (Salmo salar) IN VARIOUS LIGHT CONDITIONS. Biol. Bull., 147(2): 422-432.

Atlantic salmon parr exposed to a 12 hr light-12 hr dark cycle (LD 12:12) for ten days were entrained to a 24.0 hr periodicity in locomotor activity. Thirty-five fish were light-active, 20 were dark-active and 32 were active primarily when lights were turned on or off. Fish maintained in constant conditions (75) were generally aperiodic. Five fish (of 30) in constant darkness (DD) showed evidence of 24.0 hr periodicity. Twelve fish exposed to a light signal of 1 hr duration recurring every 23 hr failed to become entrained. Fish in constant light (LL) showed more activity than fish in DD. The results suggest (1) that light-dark transitions are more important in synchronizing locomotor activity rhythms and (2) that locomotor activity is not a good indicator of possible circadian oscillations in this species. (Authors' summ.)

18931. Allen, Kenneth O. (U. S. Fish & Wildlife Service, Fish Farming Exp. Sta., Stuttgart, Arkansas 72160). 1974. EFFECTS OF STOCKING DENSITY AND WATER EXCHANGE RATE ON GROWTH AND SURVIVAL OF CHANNEL CATFISH Ictalurus punctatus (Rafinesque) IN CIRCULAR TANKS. Aquaculture, Vol. 4: 29-39.

Channel catfish were cultured for 177 days in circular tanks containing 1.6 m^3 of water at combinations of five stocking densities (90-720 fish/m^3) and five water exchange rates (2.0-0.5 h per exchange). Net yield increased as stocking density increased up to 540 fish/m^3 then declined at higher densities. Mean fish weight, feed conversion efficiency and survival all declined as stocking density increased. Water exchange rates of 1.5 h or greater achieved similar results at stocking densities of 180 and 360 fish/m^3. However, at a density of 540 fish/m^3 a faster exchange rate resulted in increased growth, feed conversion efficiency and survival. At 2.0 h per exchange, these parameters were depressed at 180 and 360 fish/m^3. The following predictive equations ($P = 0.01$) were formulated from the data, where x_1 represents the stocking density and x_2 the exchange rate. Net yield: $Y_1 = -64.785 + 0.512x_1 + 121.977x_2 - 2.25 \times 10^{-5}x_1^2 - 43.989x_2^2 - 0.104x_1x_2$. Mean fish weight: $Y_2 = 26.649 - 0.346x_1 + 246.384x_2 - 97.551x_2^2$. Feed conversion efficiency: $Y_3 = 1.799 - 9.673 \times 10^{-4}x_1 + 0.464x_2^2$. The maximum predicted net yield of 93.1 kg occurs at a stocking density of 399 fish/m^3 and 0.91 h per exchange. (Auth.)

18932. Carr, John F. 1973. THE ROLE OF THE INTERNATIONAL ASSOCIATION FOR GREAT LAKES RESEARCH IN RESEARCH OF THE GREAT LAKES. Reprint: Proc. first fed. conf. Great Lakes (Tudor T. Davies, Ed.), U. S. Interagency Comm. Mar. Sci. Eng., pp. 324-329.

The first conference on Great Lakes Research, held in July 1953, represented the first meeting of Great Lakes investigators for the discussion of common problems and needs and the exchange of ideas about the present status of research on these Lakes and future plans. By the time of the Fourth Conference in 1961, it was apparent that the conference should be held annually. At the Ninth Conference in 1966, it was decided that a formal organization was needed to sponsor the conferences on Great Lakes research. Bylaws were adopted, and the first formal meeting of the International Association for Great Lakes Research (IAGLR) was held in 1967 at the time of the Tenth Conference. The objectives of IAGLR were stated as the "promotion of all aspects of Great Lakes research and the dissemination of research information through publications and meetings." The conferences have contributed importantly to the promotion and conduct of research on the Great Lakes, serving as an effective means of communication through discussion and publication, and as a common meeting ground for those concerned with Great Lakes problems. The International Association for Treat Lakes Research will continue to sponsor the annual conferences, but in addition the membership has been broadened to include all persons interested in research and problems of the great lakes of the world. Membership now includes engineers, economists, sociologists, political scientists, legal experts, and regional planners, as well as those in the natural sciences. A seven-member Board of Directors manages the affairs of the Association and is responsible for long-term planning and continuity of its programs and activities. Membership in the Association

is open to persons who are actively interested in research on the Great Lakes and their basins, or in research directly applicable to the understanding of management of large lakes. The Sixteenth Conference on Great Lakes Research will be held in Sandusky, Ohio, April 16-18, 1973; the Center for Lake Erie Area Research (CLEAR) of Ohio State University will be the host. Great Lakes area universities have been hosts for most of the conferences; however, federal agencies have been cohosts of two recent conferences - the Great Lakes Fishery Laboratory in 1969 (with the University of Michigan) and Canada Centre for Inland Waters in 1971 (with the University of Toronto). (Auth.)

18933. Chang, B. D., and T. R. Parsons (Inst. of Oceanogr., The Univ. of Brit. Columbia, Vancouver, British Columbia V6T 1W5, Canada). 1975. METABOLIC STUDIES ON THE AMPHIPOD Anisogammarus pugettensis IN RELATION TO ITS TROPHIC POSITION IN THE FOOD WEB OF YOUNG SALMONIDS. J. Fish. Res. Board Can., 32(2): 243-247.

The marine amphipod Anisogammarus pugettensis has been studied as part of the natural food of young salmon and as a potential organism for aquaculture projects. It has been shown to be an omnivore capable of eating seaweed, diatoms, fish pellets, and fish. It survived well under eurythermal and euryhaline conditions but grew best (14% of body weight per day) at a salinity of 28‰ and 20 C. Growth efficiency (K_1) was between 19 and 34%, depending on the size of animal and temperature. (Authors)

18934. Stickney, Robert R., and David B. White (Skidaway Inst. of Oceanography, P. O. Box 13687, Savannah, Georgia 31406). 1974. EFFECTS OF SALINITY ON THE GROWTH OF Paralichthys lethostigma POSTLARVAE REARED UNDER AQUACULTURE CONDITIONS. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 532-540.

As a part of investigations into the feasibility of rearing flounders of the genus Paralichthys for use as an aquaculture product, the effects of salinity on the growth of advanced postlarval Paralichthys lethostigma were examined. Deubler (1960) and Deubler and White (1962) demonstrated that early postlarvae grew most rapidly at high salinity 30‰). Data from the present study on two groups of advanced post-larvae indicate that these larger fish prefer low salinity water (5 to 15‰). These results indicate that P. lethostigma is physiologically adapted to its normal seasonal distribution pattern. The fish are spawned offshore and migrate to inshore waters as postlarvae. They remain inshore during spring through fall and return offshore in winter. While this species is euryhaline, its physiological adaptation to salinity appears to change seasonally and with age, thus more rapid growth of the animal under aquaculture would be expected if the salinity in which it is reared is adjusted to meet optimum physiological requirements. (Authors)

18935. Reimer, Rollin D. (Dept. of Wildl. and Fish. Sci., Texas A&M Univ., College Station, Texas 77843). 1975. Procambarus (Girardiella) curdi, A NEW CRAWFISH FROM ARKANSAS, OKLAHOMA, AND TEXAS (DECAPODA, ASTACIDAE). Tulane Studies in Zoology and Botany, 19(1-2): 22-25, illus.

Procambarus (Girardiella) curdi is described from material collected in the Red River drainage of Arkansas and Oklahoma and the Brazos River drainage of Texas. Its closest affinities are with Procambarus simulans simulans (Faxon) which occurs in the same drainage systems. (Auth.)

18936. Greenfield, D. W. (Dept. Biol. Scis., N. Illinois Univ., DeKalb, Illinois 60015). 1974. AN EVALUATION OF THE ADVISABILITY OF THE RELEASE OF THE GRASS CARP (Ctenopharyngodon idella) INTO THE NATURAL WATERS OF THE UNITED STATES. Trans. Ill. State Acad., 66, pp. 47-53; Weed Abstracts, 23(12), abstract No. 2838.

The literature on the biology and weed control potential of the grass carp is reviewed. Feeding habits, digestion, reproduction, age and growth, physiological requirements and interactions with other species are described. The advantages and disadvantages of the release of grass carp are presented and recommendations made. (From summ.)

18937. Heuschmann-Brunner, Gertrud. 1974. Aeromonas salmonicida, THE AGENT OF FURUNCULOSIS. (Aeromonas salmonicida, der Erreger der Furunkulose). Münchener Beiträge zur Abwasser, Fisch. und Flussbiol. 25: 25-32, Prinz-ludwig-Str. 10/II, 8, Munchen 2, West Germany; Fish Health News, 4(1): p. 17.

This is the most recent publication on the history of furunculosis and taxonomy of Aeromonas salmonicida. It is generally accepted that furunculosis was first described by Emmerich and Weibel in 1894. Author quotes a reference by the same authors published in 1890. The bulk of this paper deals with differences among several subspecies of A. salmonicida as established by Schubert in 1969. Schubert splits the species into three subspecies: A. salmonicida subsp. salmonicida (typical), subspecies A. salmonicida achromogenes (does not produce brown pigment) and A. salmonicida subsp. masoucida described by Kimura in Japan from "Sakuramasu" (Oncorhynchus masou). This latter utilizes cellobiose. References deal with the history and taxonomy of this fish pathogen. -- S. F. Snieszko

18938. Moore, Richard H. (Univ. of Texas Mar. Sci. Inst., Port Aransas, Texas 78373). 1974. GENERAL ECOLOGY, DISTRIBUTION AND RELATIVE ABUNDANCE OF Mugil cephalus AND Mugil curema ON THE SOUTH TEXAS COAST. Contributions in Marine Science, Vol. 18, pp. 241-255.

The general ecology, local distribution and relative abundance of the striped mullet, Mugil cephalus, and the white mullet, Mugil curema, in south Texas were studied during 1970-1971. Additional data on distribution and environmental limits gathered from 1968 through 1972 are included for comparisons. Striped mullet occurred year-round in all five habitat types sampled: open beaches, passes, primary bays, secondary bays and estuarine influenced river. White mullet occurred only between April and October and were most abundant in the passes and inlets connecting the Gulf of Mexico with the bays. The white mullet was rarely found at temperatures below 20°C and was most commonly found in a more restricted salinity range (20-35 ppt) than the striped mullet. The two species exhibit different spawning seasons, striped mullet spawning in the fall, white mullet in the spring and early summer. Both species appear to feed on the same materials, in the same places and at the same times. Limited heterospecific schooling occurs. These findings are discussed in reference to the bioenergetics and general adaptation of both species to the south Texas estuarine environment and comparisons are made between the data gathered in this study and other data drawn from the literature on the distribution of the species throughout their ranges. In general, M. curema appears as a more tropically adapted species which is less suited to life in the highly variable environment of south Texas bays as shown by their seasonal and local distribution in south Texas and elsewhere where both species occur. (Auth.)

18939. Reeves, William C. (Div. of Game and Fish, Alabama Dept. of Conserv. and Nat. Resources, Montgomery, Alabama). 1974. EFFECTS OF FEEDING REGIMES AND SOURCES OF FISH ON PRODUCTION OF ADVANCE FINGERLING STRIPED BASS. Proc. 27th Ann. Conf. of Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 540-547.

Research on the production of advanced fingerling striped bass, Morone saxatilis (Walbaum), was conducted in ponds at Auburn University Fisheries Research Unit in the summer and winter of 1971. Investigations were conducted to determine the effects of two feeding regimes and two sources of small fingerlings on the survival and production of advanced fingerling striped bass. Fingerling striped bass from the Cooper River, South Carolina, and the Savannah River, Georgia, were studied. Higher survival and greater production were obtained from the Cooper River fish. One feeding regime fed hourly, 15 hours per day; the other fed at 3-hour intervals, 15 hours per day. The two feeding regimes were not significantly different. (Auth.)

18940. Held, John W., and John J. Peterka (Dept. of Zool., No. Dakota State Univ., Fargo, North Dakota 58102). 1974. AGE, GROWTH, AND FOOD HABITS OF THE FATHEAD MINNOW, Pimephales promelas, IN NORTH DAKOTA SALINE LAKES. Trans. Amer. Fish. Soc., 103(4): 743-756.

18941. Beal, A. R. (Dept. of the Environ., Fish., and Mar. Service, Freshwater Inst., Inspection Branch, Winnipeg, Manitoba R3T 2N6, Canada). 1975. SELENIUM DETERMINATION ON FISH TISSUE. J. Fish. Res. Board Can., 32(2): 249-252.

A wet-digestion procedure for selenium analysis of fish is described. It involves digestion of the fish tissue homogenate in a nitric-perchloric-sulfuric acid mixture and subsequent complexing with 2,3-diaminonaphthalene. Interfering elements are masked with disodium (ethylenedinitrilo)-tetraacetate prior to complexing. The slope of standards is consistent and recoveries range from 85 to 100%. (Auth.)

18942. Cooke, C. Robert, Jr., and Richard G. Mooney (Texas Parks & Wildlife Dept., Olmito State Fish Hatchery, Inland Fish. Function, Brownsville, Texas 78520). 1974. MARINE FISH PROPAGATION WITH ATLANTIC CROAKER. Texas FA Project F-20-R; World Mariculture Soc. Workshop, pp. 155-161.

Atlantic croaker (Micropogon undulatus) were collected by hook and line in the lower Laguna Madre at Port Isabel, Texas. The fish were transported to the Olmito State Fish Hatchery at Brownsville, Texas in a 3,780 liter transport tank. At the hatchery each fish was weighed, cathetered for egg sample, and placed in a 3,780 liter plastic swimming pool. Female croaker were injected with 300 I.U. of chorionic gonadotrophin per 454 g of body weight. The hormone caused the croaker to gain 50 g of water weight, and eggs matured in 33 hours after injection at 22 to 25 C. At this time, eggs were stripped into a small bowl, and milt was added and spread with a feather. Saltwater was added to activate sperm and diatomaceous earth was used to coat eggs to prevent clumping. Fertilized eggs were placed in various incubating systems to determine the best system for croaker and related species. Hatching began at 20 hours after the eggs were placed in incubators when the temperature was held at 20 to 25 C. At hatching the larvae were approximately 1.5 mm in length, transparent, eyes unpigmented, and digestive system and mouth lacking. (Authors)

18943. Mestrov, M., and V. Tavcar (Inst. Biol., Svencilista u Zagrebu, Zagreb, Yugoslavia). 1973. PROBLEMS OF THE RECOVERY OF TRAKOSCAN LAKE AND APPLICATION OF GRASS CARP (Ctenopharyngodon idella [Val.]). Bulletin Scientifique, Conseils de l'Academie des Sciences et des Arts, RST Yougoslavie, A 18(4/6): 80-81; Weed Abstracts, 23(9): abstract 1855, 1974.

The artificial 17-ha Trakoscan Lake is choked with mud and mud occupies 37% of the total cubic capacity; abundant aquatic vegetation in 1971 increased sedimentation of o.m. and raised the bottom of the lake. Grass carp were introduced in 1971 to control the aquatic vegetation. The soft-tissued Myriophyllum and Ceratophyllum spp. were eliminated first and then the fish attacked Trapa natans, the third most dominant species, eliminating it by 1972. The area occupied by Nymphaea alba increased as the area under Phragmites communis was reduced. The main consumer of carbon dioxide disappeared with the elimination of the dominant macro-vegetation leading to a vigorous increase in the dissolved carbon dioxide content of the water. Strong fluctuations in the quantitative composition of zoo- and phytoplankton reflected the imbalance in the ecosystem caused by the introduced fish: Diatomeae, an important source of oxygen almost entirely disappeared in October and November 1971. It is concluded the grass carp could not reclaim the lake unaided; sedimentation ponds were required at all the main inlets to the lake.

18944. Albaugh, Douglas W. (Dept. of Wildl. and Fish. Sciences, Texas A&M Univ., College Station, Texas 77843). 1975. A NEW CRAWFISH OF THE GENUS Procambarus, SUBGENUS Capillicambarus, FROM TEXAS, WITH NOTES ON THE DISTRIBUTION OF THE SUBGENUS. Tulane Studies in Zoology and Botany, 19, No. 1 and 2, pp. 1-7.

A new species is described, on the basis of 43 first form males from Brazoria County, Texas. New distributional records for Procambarus hinei and P. incilis, the other known members of the subgenus, include ten new county records. The ranges suggest that rivers are significant barriers separating these species from one another. (Auth.)

18945. Rogers, Bruce A., and Deborah T. Westin (Marine Exp. Sta., Univ. of Rhode Island, Kingston, Rhode Island 02881). 1975. A BIBLIOGRAPHY ON THE BIOLOGY OF THE STRIPED BASS, Morone saxatilis (Walbaum). Univ. of R. I. Marine Technical Report No. 37, 134 p., price $1.00, available from the Marine Advisory Service, U.R.I., Narragansett Bay Campus, Narragansett, R.I. 02882.

A bibliography on the biology of the striped bass containing over 950 references.

18946. Larson, K. W., and G. W. Brown, Jr. (Coll. of Fish., Univ. of Washington, Seattle, Washington 98195). 1975. SYSTEMATIC STATUS OF A MIDWATER POPULATION OF FRESHWATER SCULPIN (Cottus) FROM LAKE WASHINGTON, SEATTLE, WASHINGTON. J. Fish. Res. Board Can., 32(1): 21-28.

A population of freshwater sculpin from Lake Washington differs from other species of the typically benthic genus Cottus in that individuals migrate nightly to the surface and midwaters. Individuals are phenotypically and biochemically similar to Cottus aleuticus, but have a longer, more terete body, a larger cephalic pore and canal system, shorter pelvic fins, and a higher frequency of individuals with seven branchiostegal rays per side. A close relationship between the Lake Washington population and C. aleuticus seems indicated because of their phenotypic and biochemical similarities and because of the existence of individuals in other Northwest lakes that appear intermediate in character between C. aleuticus and the Lake Washington population. The decision as to the specific status of the Lake Washington population is deferred until more is known of its degree of reproductive isolation from C. aleuticus and of the existence of these possibly intermediate populations. (Authors)

18947. Tubb, Richard A. (Ohio State Univ., Columbus, Ohio 43210). 1974. DETECTION OF Myxosoma cerebralis SPORES IN TROUT HOLDING FACILITIES. Commercial Fish. Res. Develop. Act. Completion Report 1970 to May 13, 1974, 59 p., mimeo; Fish Health News, 4(1): p. 22.

Methods were developed to inoculate aquaria with a known concentration of viable spores of Myxosoma cerebralis. Threshold concentrations of spores necessary to infect rainbow trout fry varied from 8,581 to 23,256 per liter. The variation in infection rates was attributed to the condition of the spores, natural resistance of fry to infection, and the length of time fry were exposed to spores. Spore numbers in an infected population of fish generally increased from the first spore detection at 90 days to 240 days after exposure. Ninety days were required to age spores in an aquarium prior to placing fry in the aquarium. The length of time required for incubation of spores and the variation in results do not justify the method for detecting spores in trout holding facilities at this time. Carefully controlled large scale tests are needed to perfect the method and reduce variability encountered in the threshold concentrations necessary for infection. (Auth.)

18948. Antipa, Ross (Washington Coop. Fish. Unit, Coll. of Fish., Univ. of Wash., Seattle, Washington 98195). 1974. FOOD HABITS OF LACUSTRINE SALMONIDS IN WASHINGTON STATE IN RELATION TO INFECTIONS WITH LARVAE OF THE BASS TAPEWORM (Proteocephalus ambloplitis). Trans. Amer. Fish. Soc., 103(4): 811-814.

Analysis of stomach contents of rainbow trout, cutthroat trout, and coho salmon from four lakes revealed a diversity of feeding habits. Copepods were the most frequently observed food items in the stomachs of the three salmonids. Cyclopoid copepods were most abundant in rainbow trout (198/fish), and less abundant in coho salmon (150/fish) and cutthroat trout (142/fish), respectively. Between 89-93% of the copepods found in stomach contents were Cyclops bicuspidatus, a species found to transmit bass tapeworm larvae to rainbow trout in laboratory experiments. (Auth.)

18949. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA, 78850 Thiverval-Grignon, France). 1974. ON THE USE OF COPPER SULFATE IN THERAPEUTIC PISCICULTURE (Sur l'Utilisation du Sulfate de Cuivre en Therapeutique Piscicole). Bulletin Francais de Pisciculture, Technical Note No. 0.2, 254(3): 11-12. In French.

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18950. Smith, Charlie E., Myron Brin, and John E. Halver (U.S. Fish & Wildlife Service, Western Fish Nutr. Lab., Cook, Washington 98605). 1974. BIOCHEMICAL, PHYSIOLOGICAL, AND PATHOLOGICAL CHANGES IN PYRIDOXINE-DEFICIENT RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Board Can., 31(12): 1893-1898.

Rainbow trout (Salmo gairdneri) fed a pyridoxine-deficient diet developed clinical signs of the deficiency after 8 wk of feeding. Erythrocyte and muscle glutamic pyruvic transaminase (GPT) concentrations were significantly depressed in deficient fish, while liver GPT was significantly elevated. Liver GPT was also elevated in starved trout suggesting the increase in enzyme concentrations was secondary to the deficiency. A normocytic, normochromic anemia, which responded favorably to pyridoxine, developed in pyridoxine-deficient trout. Microscopic lesions were found in gastrointestinal tract, kidney, liver, pancreas, and thymus of deficient fish. (Authors)

18951. Shcherbina, M. A., and S. P. Tryamkina (All-Union Pond Fisheries Res. Inst. (VNIIPRKh), Rybnoye Settlement, Moscow Province, USSR). 1974. AVAILABILITY TO YEARLING RAINBOW TROUT [Salmo irideus (Gibb.)] OF AMINO ACIDS FROM DIETS CONSISTING LARGELY OF FISH MEAL AND SPLEEN. J. Ichthyol, 14(1): 109-114.

Experimental data are given on the content of 9 essential and 6 nonessential amino acids in diets and the indicators of their availability for rainbow trout (Salmo irideus Gibb.) yearlings. Aspects of the correspondence between the requirements of the fish and the quantitative content of available amino acids in the diets are discussed.

18952. Kruger, Andrzej (Inst. Rybactwa Srodladowego w Olsztynie, Zaklad Gospodarki Stawowej, Poland). 1973. METHOD OF LABELLING Anguilla anguilla (Linnaeus 1758) SPECIES WITH IODINE RADIONUCLEIDES AND VERIFICATION OF IT IN THE EXPERIMENT WITH SILVER EEL USING ^{131}J. (Metoda znakowania gatunku Anguilla anguilla (Linnaeus 1758) radionuklidami jodu i jej weryfikacja w doswiadczeniu z wegorzem srebrzystym, przy uzyciu ^{131}J). Roczniki Nauk Rolniczych, 95(3): 51-67. In Polish.

Review of the present state of knowledge on the methods of labelling fish, considering especially the isotopic methods used hitherto. In the present work it was given the motivation of the suggestion to use the iodine isotope for labelling eel. The elaborated method for labelling eel with iodine radionucleides was verified in experimental labelling the silver eel with ^{131}J.

18953. Brogden, William B., Joseph J. Cech, Jr., Carl H. Oppenheimer (The Univ. of Texas Marine Science Inst., Port Aransas, Texas 78373). 1974. A COMPUTERIZED SYSTEM FOR THE ORGANIZED RETRIEVAL OF LIFE HISTORY INFORMATION. Chesapeake Science, 15(4): 250-254.

This paper describes a computerized system for storage and retrieval of information on life history and environmental limits of organisms, which we have applied to the estuarine and nearshore organisms of the Texas coast. The system uses standard biological nomenclature instead of codes, and provides great flexibility both in search criteria and output format. Each entry for an organism is derived from a separate literature reference. Forty descriptors are used, covering taxonomic identification, environment, classification, distribution in time, environmental limits, trophic relationships, and reference identification. The same format is also used to record laboratory experiment derived environmental limits such as LD50 values. An interactive terminal can be used for rapid access to the data base. The system is being used by both coastal zone management planners and estuarine ecologists. (Authors)

18954. Funk, John L., and George G. Fleener (Missouri Dept. of Conservation, Columbia, Missouri 65201). 1974. THE FISHERY OF A MISSOURI OZARK STREAM, BIG PINEY RIVER, AND THE EFFECTS OF STOCKING FINGERLING SMALLMOUTH BASS. Trans. Amer. Fish. Soc., 103(4): 757-771.

18955. Anderson, J. W., J. M. Neff, B. A. Cox, H. E. Tatem, and G. M. Hightower (Dept. of Biol., Texas A&M Univ., College Station, Texas 77843). 1974. CHARACTERISTICS OF DISPERSIONS AND WATER-SOLUBLE EXTRACTS OF CRUDE AND REFINED OILS AND THEIR TOXICITY TO ESTUARINE CRUSTACEANS AND FISH. Marine Biology, 27(1): 75-88.

The quantitative hydrocarbon composition and behavior in seawater of water-soluble fractions (WSF) and oil-in-water dispersions (OWD) of 4 oils was investigated. Two crude oils, South Louisiana crude and Kuwait crude, and two refined oils, No. 2 fuel oil and bunker C residual oil, were used in these investigations. The WSFs of the crude oils had higher total oil-hydrocarbon concentrations and were richer in light aliphatics and single-ring aromatics than were the WSFs of the refined oils. The WSFs of the refined oils contained significantly higher concentrantions of naphthalenes than did those of the crudes. The hydrocarbon composition of the aqueous phase of OWDs closely resembled that of the parent oils. Gentle aeration of the OWDs resulted in a loss of 80 to 90% of the aqueous hydrocarbons in 24 h. Alkanes disappeared from the dispersions more rapidly than aromatics. The WSFs and OWDs of the refined oils were considerably more toxic to the 6 test species than were those of the crude oils. The test species can be ranked according to increasing sensitivity to oil as follows: Cyprinodon variegatus, Menidia beryllina, Fundulus similus, Penaeus aztecus postlarvae, Palaemonetes pugio and Mysidopsis almyra. The results of this investigation are discussed in relation to the potential impacts of oil spills on the marine and estuarine environments. (Authors)

18956. McCarthy, D. H. (Min. of Agric., Fish., and Food, Fish Diseases Lab., Weymouth, Dorset, England). 1974. OCCURRENCE OF HEMATOZOA IN ATLANTIC SALMON (Salmo salar) SMOLTS AND ADULTS IN AN ENGLISH RIVER. J. Fish. Res. Board Can., 31(11): 1790-1792.

The percentages of hemoflagellates found in single samples of Atlantic salmon (Salmo salar) from the River Exe, Devon, in 1971 (122 fish) and 1973 (50 fish) were 33 and 32; of hemogregarines, 18 and 22. The percentages for 21 adults taken in the estuary in August 1971 were 14 and 0, respectively; in 9 adults taken in the estuary in March 1972 and in 9 taken in fresh water in November 1971, no hematozoa were found. Statistical analysis of hemoglobin data showed no significant difference between parasitized and healthy fish. Neither the specific identities nor the vectors of the hematozoa were determined. (Authors)

18957. Paloheimo, J. E., and P. F. Elson. 1974. EFFECTS OF THE GREENLAND FISHERY FOR ATLANTIC SALMON ON CANADIAN STOCKS. The International Atlantic Salmon Foundation, Spec. Publication Series, 5(1).

Tag returns show that substantial numbers of salmon produced in the Canadian maritimes are caught in Greenland waters. The percentage recoveries in the home river system studied (Miramichi) show a gradual decline which is significantly correlated with the gradual buildup of catches in Greenland. Detailed data collected on the Miramichi system since 1950 indicates that the onset of the Greenland fishery is one of the major, if not the most significant, changes which have taken place in fishing affecting Canadian Atlantic salmon since that time. The level of landings was higher per million smolts produced in the Miramichi system after the Greenland fishery began than prior to it. The estimated escapement from the fishery and the potential spawning stock of salmon per given number of smolts was correspondingly lower and has a significant, inverse correlation with the landings in Greenland. Lower escapement implies lower abundance of progeny or underyearlings. Significantly, recruitment as measured by the numbers of underyearlings produced is shown to depend more crucially on the numbers of salmon escaping the fishery than on the numbers of grilse. Statistical analysis indicates that the Greenland fishery has a direct adverse effect on the numbers of salmon surviving to enter their spawning river.

18958. Clark, Stephen H. (Rosenstiel School of Mar. and Atmospheric Sci., Univ. of Miami, 10 Rickenbacker Causeway, Miami, Florida 33149). 1974. A STUDY OF VARIATION IN TRAWL DATA COLLECTED IN EVERGLADES NATIONAL PARK, FLORIDA. Trans. Amer. Fish. Soc., 103(4): 777-785.

18959. Pate, Preston P., Jr. (No. Carolina Dept. of Natural and Economic Res., Div. of Comm. and Sport Fisheries, North Carolina). 1974. AGE AND SIZE COMPOSITION OF COMMERCIAL CATCHES OF BLUEBACK HERRING AND ALEWIFE IN ALBEMARLE SOUND, N.C. AND ITS TRIBUTARIES. Proc. of 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 560-569.

Data on commercial catches of blueback herring and alewife were collected at eight locations in the Albemarle Sound area. Scale samples were taken from 1,214 bluebacks and 787 alewife. Bluebacks ranged in age from three to nine years. Alewife ranged in age from three to eight years. Age groups IV and V dominated catches of both species. Data from all locations combined indicated that virgin fish comprised 50 and 57 percent of the landings of blueback and alewife respectively. Samples from Scuppernong River contained 78 percent virgin bluebacks and 92 percent virgin alewife. Data from Scuppernong River were compared to data from Alligator River in 1973. Blueback samples from Scuppernong River contained 79 percent virgins while samples from Alligator River contained 45 percent virgin bluebacks. A possible problem of over-exploitation exists in Scuppernong River. (Auth.)

18960. Ware, D. M. (Dept. of the Environ., Fish. and Mar. Serv., Mar. Ecol. Lab., Bedford Inst. of Oceanogr., Dartmouth, Nova Scotia B2Y 4A2, Canada.) 1975. GROWTH, METABOLISM, AND OPTIMAL SWIMMING SPEED OF A PELAGIC FISH. J. Fish. Res. Board Can., 32(1): 33-41.

Ivlev's (1960) study of young-bleak (Alburnus alburnus) is reanalyzed to determine whether or not the routine swimming speeds of planktivorous fishes could have evolved to maximize some obvious measures of biological performance - namely the growth rate, the growth efficiency, or the growth efficiency arising from a particular food ration. Each criterion had a maximum value at a different swimming speed. But for bleak the observed speed of 107 m h^{-1} was closest to the one, 111 m h^{-1}, which maximizes growth. The possible evolutionary significance of this finding is discussed. (Auth.)

18961. Mathers, J. S., and F. W. H. Beamish (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1974. CHANGES IN SERUM OSMOTIC AND IONIC CONCENTRATION IN LANDLOCKED Petromyzon marinus. Comp. Biochem. Physiol., 49(4A): 677-688.

Serum osmolarity of landlocked sea lampreys, held in fresh water, was measured throughout the life cycle. Osmolarity of ammocoetes and spawning lampreys was similar but less than that of macrophthalmia or immature adults. The capacity of landlocked Petromyzon marinus to osmoregulate in saline solutions was investigated at various stages of the life cycle. Not until the early macrophthalmia stage was reached were lampreys able to osmoregulate in dilute sea water. Immature adult lampreys were able to osmoregulate in salinities ranging from 0 to 34 °/oo for short periods; however, in salinities greater than 16 °/oo only larger lampreys could osmoregulate for long periods. Serum osmotic and ionic concentrations of lampreys osmoregulating in hyperosmotic salinities were higher than those of lampreys in hyposmotic salinities. (Authors)

18962. Schueler, Robert L. (Water Resources, Nat'l. Marine Fish. Serv., Washington, D. C.). 1974. THE MATCHED PAIR - NATIONAL ENVIRONMENTAL POLICY ACT AND THE FISH AND WILDLIFE COORDINATION ACT. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 548-559.

Short description of both pieces of legislation highlighting the similarities and differences; the strengths and limitations of each. Based on recent National Marine Fisheries Service's experience concludes that both can be used in a mutually supportive manner to benefit fish and wildlife resources. (Auth.)

18963. Shultz, Cynthia D., W. L. Yanger, Jr., and A. Bevenue (Univ. of Hawaii, Dept. of Agric. Biochem., Honolulu, Hawaii 96822). 1975. PESTICIDES IN FISH FROM A HAWAIIAN CANAL. Bull. Environ. Contamin. Toxicol., 13(1): 206-208.

18964. Fraser, J. M. (Ontario Min. of Nat. Resources, Fish and Wildlife Research Branch, Maple, Ontario, Canada). 1974. AN ATTEMPT TO TRAIN HATCHERY-REARED BROOK TROUT TO AVOID PREDATION BY THE COMMON LOON. Trans. Amer. Fish. Soc., 103(4): 815-818.

Hatchery-reared yearling brook trout (Salvelinus fontinalis) were trained in 1970 and 1972 to avoid an electrified plastic model loon moving through the water in a hatchery raceway. Immediately after the training programs, the trout were released together with untrained trout in a 23-ha lake which accomodated 2-3 common loons and other potential predators. Intensive gill netting 10-12 wk after planting indicated about 16% survival of trained trout compared to about 18% for untrained trout. The training received by the trout apparently had little survival value in the wild. The low survival rates experienced by all groups suggested a high level of predation. (Auth.)

18965. Sprules, W. Gary (Dept. of Zool., Erindale Coll., Univ. of Toronto, Mississauga, Ontario L5L 1C6, Canada). 1975. MIDSUMMER CRUSTACEAN ZOOPLANKTON COMMUNITIES IN ACID-STRESSED LAKES. J. Fish. Res. Board Can., 32(3): 389-395.

The distribution of limnetic crustacean zooplankton species and species associations in 47 industrially acidified lakes of the La Cloche Mountains, Ontario, are examined. pH, which ranged from 3.8 to 7.0, and to a lesser extent lake area and depth are the major determinants of the structure of these communities. Mesocyclops edax, Cyclops bicuspidatus thomasi, Diaptomus minutus, Holopedium gibberum, Diaphanosoma leuchtenbergianum, and Bosmina sp. were common species which occurred over the entire pH range. Tropocyclops prasinus mexicanus, Epischura lacustris, Diaptomus oregonensis, Leptodora kindtii, Daphnia galeata mendotae, D. retrocurva, D. ambigua, and D. longiremis plus some other rare species making a total of 64% of all species found never or rarely occurred below pH 5.0. Polyphemus pediculus, Daphnia catawba, and D. pulicaria were found primarily in lakes with low pH. An increase in the communities contained 9-16 species with three or four dominant species; in lakes with pH 5.0 or less the communities comprised one to seven species with only one or two dominants. Compared with relatively unspoiled lakes of similar morphometry in northwestern Ontario (ELA lakes) the La Cloche lakes have unusually simple zooplankton associations, particularly the very acidic lakes. Recurrent group analysis of the La Cloche and ELA lakes indicated that they were both characterized by a single major recurrent group of six species, five of which were common to the two areas. In the La Cloche lakes the group of six species occurred most frequently in lakes with pH above 5.0 although it maintained its integrity even down to pH 5.0. It is concluded that pH has a great effect on these zooplankton communities, primarily in lakes with pH below 5.0 where many species are completely eliminated and even tolerant species become progressively rarer until in some lakes a single species (D. minutus) remains. (Auth.)

18966. Zuboy, James R., Robert T. Lackey, Norville S. Prosser, and Raymond V. Corning (Dept. of Fish. & Wildl. Sciences, Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1974. COMPUTERIZED CREEL CENSUS SYSTEM FOR USE IN FISHERIES MANAGEMENT. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 570-574.

A computerized creel census system that is nearly automatic after initial field data recording is described. Partially prepunched computer cards are used to record creel data. Cards are processed directly by computer and a detailed tabulation provided to the fisheries manager. The entire system is designed for ease of use in that no programming knowledge is required of the user. (Authors)

18967. Robinson, Susan, and W. B. Scott (Dept. of Mineralogy, Royal Ontario Museum, 100 Queen's Park, Toronto, Canada). A SELECTED BIBLIOGRAPHY ON MERCURY IN THE ENVIRONMENT, WITH SUBJECT LISTING. Life Sci. Misc. Publ., R. Ont. Mus., ISBN 0-88854-166-X, Sept. 30, 1974, 54 p. Price $1.25.

18968. Potter, I. C., and F. W. H. Beamish (Univ. of Bath, England). 1975. LETHAL TEMPERATURES IN AMMOCOETES OF FOUR SPECIES OF LAMPREYS. Acta Zoologica, 56(1): 85-91.

18969. Fromm, Paul O. (Dept. of Physiol., Michigan State Univ., East Lansing, Michigan 48824). 1974. CIRCULATION IN TROUT GILLS: PRESENCE OF "BLEBS" IN AFFERENT FILAMENTAL VESSELS. J. Fish. Res. Board Can., 31(11): 1793-1796.

Casts of the gill vasculature of rainbow trout (Salmo gairdneri) perfused with Microfil were examined visually. The most conspicuous feature seen was enlargements, called blebs, of the afferent filamental vessels that were located in the outermost region of the interfilamental septa. Several lamellae were supplied by profusely branched afferent lamellar vessels, whereas most lamellae were individually connected to the efferent filamental vessel. Vessels contained in the septal area and those that ran parallel to the long axis of the filaments are also described and possible functions of the blebs are discussed. (Auth.)

18970. Bailey, Randy E., O. Eugene Maughan, and Carl B. Schreck (Dept. of Fish. and Wildl., Sciences, Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1974. AN EVALUATION OF CATCHABLE TROUT MOVEMENT USING TWO MARKING TECHNIQUES. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 574-577.

Two marking techniques, freeze branding and subcutaneous tags, were used to evaluate movement of catchable rainbow trout (Salmo gairdneri) stocked into Rich Creek, West Virginia. These marks proved to be a valuable tool in studies requiring both rapid recognition of marked fish and identification of individuals. In general, there was a marked movement of trout downstream from the point of release, even during periods of low water conditions. Mean distances moved in both directions were 465 meters downstream and 197 meters upstream, respectively. (Authors)

18971. Hardy, Jerry D., Jr., and Robert Karl Johnson (Chesapeake Biol. Lab., Nat. Res. Inst., Univ. of Maryland, Solomons, Maryland 20688). 1974. DESCRIPTIONS OF HALFBEAK LARVAE AND JUVENILES FROM CHESAPEAKE BAY (PISCES: HEMIRAMPHIDAE). Chesapeake Science, 15(4): 241-246.

Descriptions and illustrations of larvae and juveniles of the ballyhoo, Hemiramphus brasiliensis (Linnaeus) and Hyporhamphus sp. are provided, based on specimens from Chesapeake Bay and its tributaries. The first captures of young He. brasiliensis in estuarine conditions are recorded and the first documented record of this species from Maryland waters of Chesapeake Bay is offered. (Authors)

18972. Holub, B. J., J. T. H. Connor, and S. J. Slinger (Dept. of Nutrition, Univ. of Guelph, Guelph, Ontario N1G 2W1, Canada). 1975. INCORPORATION OF GLYCEROL-3-PHOSPHATE INTO THE HEPATIC LIPIDS OF RAINBOW TROUT, Salmo gairdneri. J. Fish. Res. Board Can., 32(1): 61-64.

The incorporation of sn-[^{14}C]glycerol-3-phosphate into the liver lipids of rainbow trout (Salmo gairdneri) was studied using a homogenate preparation. The reaction was dependent upon added palmitoyl-CoA as a source of activated fatty acid and lysophosphatidic acid as well as phosphatidic acid were found by means of thin-layer chromatography to be important metabolic products. The optimal conditions for studying glycerol-3-phosphate acyltransferase activity in the liver of rainbow trout are given. The maximum rate of entry of glycerol-3-phosphate into lipid esters was 91μ moles/g liver per hour. (Authors)

18973. Boyd, Claude E., and Ellen Scarsbrook (Dept. of Fish. & Allied Aquacult., Auburn Univ., Agric. Exper. Sta., Auburn, Alabama 36830). 1974. EFFECTS OF AGRICULTURAL LIMESTONE ON PHYTOPLANKTON COMMUNITIES OF FISH PONDS. Arch. Hydrobiol., 74(3): 336-349.

Liming of fish ponds with dolomitic limestone increased primary production as determined by increased numbers of phytoplankters and greater phytoplankton volumes. Species composition of phytoplankton communities was not obviously affected by liming. Favorable influences of lime resulted from one or more of the following observed changes in the pond environments: 1) increased carbon for photosynthesis following increases in bicarbonate, 2) greater availability of phosphorus added in fertilizers, and 3) increased concentrations of calcium and magnesium. (Authors)

18974. Parker, R. O., Jr., R. B. Stone, C. C. Buchanan, and F. W. Steimle, Jr. (Atlantic Estuarine Fish. Center, NMFS, NOAA, Beaufort, North Carolina 28516). 1974. HOW TO BUILD MARINE ARTIFICIAL REEFS. Dept. of Comm., NOAA, Fishery Facts 10, 47 p. illus.

Artificial reefs provide or improve rough bottom habitat and offer fishery scientists and administrators an effective technique to conserve and develop coastal fishery resources. With careful planning and organized efforts, local reef committees can build reefs to improve fishing and contribute to the recreational and financial growth of coastal communities. Advice and procedures are presented for: 1) selecting construction materials, 2) determining a suitable reef site, 3) obtaining permits, 4) buoying the reef, and 5) preparing, transporting, and placing reef-building materials. Included in appendixes are instructions for preparing permits, addresses of Federal and State agencies involved in approving or funding reef construction, and addresses of manufacturers of materials and equipment. (Authors)

18975. Alderdice, D. F., and C. R. Forrester (Dept. of the Environ., Fish. and Mar. Service, Pacific Biol. Sta., Nanaimo, British Columbia V9R 5K6, Canada). 1974. EARLY DEVELOPMENT AND DISTRIBUTION OF THE FLATHEAD SOLE (Hippoglossoides elassodon). J. Fish. Res. Board Can., 31(12): 1899-1918.

Laboratory studies were conducted on eggs from a southern British Columbia population of Hippoglossoides elassodon. Salinity of neutral buoyancy of eggs decreased from about 25 °/oo shortly after fertilization to 17-18 o/oo at hatching. The incubation period ranged from 20.9 days (2.36-4.0 C) to 7.2 days (10.65 C). At temperatures of 5.5 C or lower and salinities of 19 °/oo or lower, larvae tended to hatch at a less advanced stage of development. Mean length of newly hatching larvae increased in successive periods throughout the hatching interval. At mean hatching time, larval length varied from 3.2 mm (15 °/oo, 3.0 C) to 6.3 mm (25 °/oo, 6 C). Larvae from eggs incubated over the range of test conditions (10.42-39.58 o/oo, 2.36-10.65 C) reached a length of 6.9-7.2 mm at yolk exhaustion. Hatching success was highest in trials at 25 °/oo, 6 and 7 C; maximum percent viable hatch is predicted at incubation conditions of 29.16 °/oo, 7.38 C. Posthatching larval survival appeared normal at salinities of about 20-37 °/oo and temperatures of about 5.5 to ≥ 10.65 C. Extensive early larval mortality occurred at salinities of 19 °/oo or less and at temperatures below 5.5 C. Incipient low lethal temperature levels are estimated to be near 3.5-4.0 C for incubating eggs and 4.0-4.5 C for larvae. Egg and larval characteristics of the experimental material were compared with similar data from the literature on North Pacific Ocean Hippoglossoides. A number of previous distinctions made between eggs and larvae of H. elassodon, H. robustus, and H. dubius require further validation owing to the possible confounding of genetic and environmental influences on the attributes studied. Distribution and abundance of H. elassodon over its North American range is discussed on the basis of the evidence gathered. (Authors)

18976. Zweiacker, Paul L., and Robert C. Summerfelt (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma 74074). 1974. SEASONAL VARIATION IN FOOD AND DIEL PERIODICITY IN FEEDING OF NORTHERN LARGEMOUTH BASS, Micropterus s. salmoides (Lacepede), IN AN OKLAHOMA RESERVOIR. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 57-541.

Food habits of 810 northern largemouth bass, 91-2724 g total weight (age groups 0-7) were determined from collections made June 1968 through November 1969 in an 808-hectare, Oklahoma reservoir. Bass were collected by traversing the shoreline with an electrofishing apparatus and bass stomach contents observed with a gastroscope. Fifty-five percent of all bass stomachs were empty. Similar observations over a wide geographic area were reviewed and the suggestion was made that 56% occurrence of empty stomachs may be used as a guide to evaluate availability of forage for largemouth bass. Bass stomachs contained mostly crayfish and gizzard shad. Gizzard shad and partially digested fish were found in 31.1% of 810 fish, whole and partially digested crayfish were found in 13.9% of the bass. Bass swallowed crayfish and gizzard shad tail-first 96.8% and 33.5% of the time respectively. Orientation of the prey in bass stomachs did not vary with size of the bass. In 1969

largemouth bass in Lake Powell, Lake Carl Blackwell and Bull Shoals spawned in the last week of April, the coincidence appears to be related to similar photoperiod at the same latitude. Variation in percentage of empty stomachs preceding, during and after the spawning season suggested that bass, probably the males, may reduce feeding during the two week interval when they are guarding the eggs and prelarval fish. Judging from occurrences of empty stomachs, bass in this lake generally fed from midmorning through afternoon rather than between evening and morning. (Authors)

18977. Environment Canada, Fisheries and Marine Service (Ottawa, Ontario K1A 0H3, Canada). 1975. FIFTEENTH SUPPLEMENT TO LIST OF ARTICLES IN THE TRANSLATION SERIES NO. 2826 - 3325 (WITH INDEXES TO AUTHORS AND TO TRANSLATORS). Environ. Canada, Fish. and Mar. Service Translation Series 69 p.

18978. Brown, Daniel J., and Loh Lee Low (Center for Quantitative Sci. in Fish., Forestry, and Wildl., Univ. of Washington, Seattle, Wash. 98195). 1974. THREE-DIMENSIONAL COMPUTER GRAPHICS IN FISHERIES SCIENCE. J. Fish. Res. Board Can., 31(12): 1927-1935.

These illustrations of three-dimensional computer-generated graphics depict the emergence of definable areas of fisheries science where computer-drawn images yield a visual feeling for the behavior of multidimensional variables. The images are perspective and orthographic projections of a three-dimensional array of connected points which are used to present the results of computer analysis, thus reducing voluminous amounts of complex data into more easily understood visual images. The examples collected here transform information from computer models into conceptual form for humans. (Authors)

18979. Johnson, Robert Karl, and Ted S. Y. Koo (Div. of Fishes, Field Museum of Natural History, Chicago, Illinois 60605). 1975. PRODUCTION AND DISTRIBUTION OF STRIPED BASS (Morone saxatilis) EGGS IN THE CHESAPEAKE AND DELAWARE CANAL. Chesapeake Science, 16(1): 39-55.

The Chesapeake and Delaware Canal connects upper Chesapeake Bay with the Delaware River. The results of two years of intensive sampling effort in the C&D Canal suggest that this area may be one of the more important spawning grounds of striped bass, Morone saxatilis (Walbaum), in the Chesapeake Bay region. Concentrations of striped bass eggs found during the period of peak spawning may be the highest that have been reported. Limited evidence suggests that the C&D Canal has provided a favorable alternative to now destroyed historical spawning grounds of striped bass in the lower Susquehanna River. (Authors)

18980. Grygierek, Eugenia. 1973. ZOOPLANKTON AND FISH PRODUCTION IN NURSERY PONDS. (Zooplankton a produkcja ryb w stawach typu przesadek I). Roczniki Nauk Rolniczych, 95(3): 35-50. In Polish.

Material for the present work was collected during investigations and observations lasting for five years. Based upon the material obtained, a search was made for the relation between the species of zooplankton and its quantity as food and a potential predator of fish and fry production. The possibility of treating the quantitative relations between crustacea species as an indicator of trophogenity of a pond was discussed. (Auth.'s synopsis)

18981. Dolinin, V. A. (Inst. of Physiol., Siberian Dept., USSR Academy of Sciences, Novosibirsk, USSR). 1974. ENVIRONMENTAL DEPENDENCE OF THE MAIN PARAMETERS OF THE RESPIRATORY FUNCTION IN FISHES DIFFERING IN THEIR ACTIVITY AND OXYGEN REQUIREMENT. J. Ichthyol., 14(1): 122-132.

In the study we determined the absolute magnitude and the nature of alteration in the rate of gas exchange, ventilation volume, the coefficient of the uptake of oxygen from the water and the frequency of respiratory movements in pike, ide and pike-perch on reduction of O_2 concentration (from 12 to 0.2-0.4 mg/liter) in water at a temperature of 5, 10, 15 and 20°C.

18982. Satia, Benedict P., Lauren R. Donaldson, Lynwood S. Smith, and John N. Nightingale (Coll. of Fisheries, Univ. of Washington, Seattle, Wash.). 1974. COMPOSITION OF OVARIAN FLUID AND EGGS OF THE UNIVERSITY OF WASHINGTON STRAIN OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Board Can., 31(11): 1796-1799.

The concentrations of major constituents of ovarian fluid were found to be lower than reported values for the same constituents in blood and urine of rainbow trout (Salmo gairdneri). Glucose and total bilirubin were significantly correlated ($P < 0.05$) to hatchability, whereas LDH was negatively correlated ($P < 0.05$). Rainbow trout egg proteins are highly nutritional and contain a higher proportion of essential amino acids than do eggs or human or cows' milk. (Authors)

18983. DeLamater, Edward D., and Walter R. Courtenay, Jr. (Exp. Cytology Lab. and Dept. of Biol. Sci., College of Science, Florida Atlantic Univ., Boca Raton, Florida). 1974. STUDIES ON SCALE STRUCTURE OF FLATFISHES I. THE GENUS Trinectes, WITH NOTES ON RELATED FORMS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 591-608.

A detailed comparison of the scales of Trinectes maculatus (Bloch and Schneider) and T. inscriptus (Gosse) has demonstrated species specific differences valid for taxonomic purposes. A complex hinged joint attaching very large cteni to the scale plate characterizes both species. The large cteni are associated with a marked increase in skin surface which, in turn, is combined with an apparent increase in the cutaneous vascular bed suggesting a secondary respiratory and excretory function. The rigid skin flaps produced by the cteni may also be associated with a hydrodynamic "spoiler" mechanism. The lateral-line canal in both species is uniquely composed of tubes lying end to end with no ancillary scale appendages. (Authors)

18984. Hitron, John W. (Coll. of Fisheries, Univ. of Washington, Seattle, Wash. 98195). 1974. SERUM TRANSFERRIN PHENOTYPES IN STRIPED BASS, Morone saxatilis, FROM THE HUDSON RIVER. Chesapeake Science, 15(4): 246-247.

Three transferrin phenotypes observed in the serum of striped bass, Morone saxatilis, are described genetically as representing two alleles at a single locus. The distribution of the phenotypes Tf A, Tf B and Tf AB did not differ significantly among samples collected from the Hudson River, suggesting that all fish sampled were of one homogeneous population. (Auth.)

18985. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA, 78850 Thiverval-Grignon, France). 1974. ON THE EMPLOYMENT OF IODOPHORES IN PISCICULTURE. (Sur l'Emploi des Iodophores en Pisciculture). Bulletin Francais de Pisciculture, 254(3): Technical Note No. 0.3, pp. 13-15. In French.

18986. Bryan, J. E., and D. A. Kato (Dept. of the Environ., Fish. and Mar. Serv., Vancouver, British Columbia V6E 2P1, Canada). 1975. SPAWNING OF LAKE WHITEFISH, Coregonus clupeaformis, AND ROUND WHITEFISH, Prosopium cylindraceum, IN AISHIHIK LAKE AND EAST AISHIHIK RIVER, YUKON TERRITORY. J. Fish. Res. Board Can., 32(2): 283-288.

Spawning grounds used by lake (Coregonus clupeaformis) and round whitefish (Prosopium cylindraceum) were discovered in the course of an investigation on effects of hydroelectric development. The spawning period for lake whitefish extended from early November to at least mid-December 1973. Lake whitefish spawned over silt and Potamogeton in water which had little current and was 2.0-2.5 m deep. Spawning of round whitefish was probably completed in November. Round whitefish spawned during the day. Eggs were apparently broadcast over a variety of substrata ranging from silt and Potamogeton to gravel and boulder. Round whitefish eggs were deposited in both fast and slow current at depths ranging from 0.7 to 2.5 m. Although deposited in a range of habitats, round whitefish eggs seemed to be most abundant on gravel in fast current at depths less than 1 m. (Authors)

18987. Zitko, V., W. V. Carson, and W. G. Carson (Dept. of Environ., Biol. Sta., St. Andrews, New Brunswick E0G 2X0, Canada). 1975. THALLIUM: OCCURRENCE IN THE ENVIRONMENT AND TOXICITY TO FISH. Bull. Environ. Contamin. Toxicol., 13(1): 23-30.

Thallium is present in the effluents of the base-metal mining industry, and its acute toxicity to juvenile Atlantic salmon is approximately equal to that of copper. The usual treatment of waste water with alkali to remove heavy metals by precipitation has little effect on thallium. The limited use of thallium will not lead to a global contamination of the environment, but localized problems may exist or develop in the future, mainly as a result of mineral processing. (Authors)

18988. De Kinkelin, P., M. Le Berre, and A. Meurillon (Lab. d'Ichtyopathol., Thiverval-Grignon, France). 1974. VIRAL HEMORRHAGIC SEPTICEMIA OF TROUT: RESISTANCE OF COHO SALMON AND BROWN TROUT UNDER NATURAL AND EXPERIMENTAL CONDITIONS. (Septicemia hemorragique virale: demonstration de l'etat refractaire du saumon coho (Oncorhynchus kisutch) et de la truite fario (Salmo trutta). Fish Health News, 4(1): p. 18.

The aim of these experiments was to test the susceptibility of brown trout (Salmo trutta) and coho salmon (Oncorhynchus kisutch) to exposure to the virus of viral hemorrhagic septicemia (V.H.S.). Infection trials were carried out both in the fish farm and in the laboratory (infectious baths and intra-peritoneal injections). The course of the disease was followed in brown trout and coho salmon in comparison with a species sensitive to V.H.S., the rainbow (Salmo gairdneri); infection criteria being based on the mortality rate, isolation of the virus and the host reaction with respect to interferon production. In all these experiments, brown trout and coho salmon were shown to be refractory to the virus of V.H.S. while the rainbow trout displayed heavy mortalities (50% - 90%). V.H.S. virus was consistently isolated and the infection triggered production of interferon. Restocking water ways and fish farms with species refractory to V.H.S. constitutes a practical means of helping combat the dissemination of this disease. (Authors)

18989. Relyea, Kenneth, and Bruce Sutton (Dept. of Biol., Jacksonville Univ., Jacksonville, Florida 32211). 1975. A NEW TROGLOBITIC CRAYFISH OF THE GENUS Procambarus FROM FLORIDA (DECAPODA: ASTACIDAE). Tulane Studies in Zoology and Botany, 19(1 and 2): 8-16, illus.

A new troglobitic crayfish of the genus Procambarus is described from northern Florida. The new crayfish is most closely related to P. lucifugus lucifugus and P. lucifugus alachua. The Florida troglobitic crayfishes are illustrated, and a key to them is presented. (Authors)

18990. Buchanan, Johnny P. (Tennessee Valley Authority, Div. of Forestry, Fish., and Wildl. Development, Fish. and Waterfowl Resources Branch, Muscle Shoals, Alabama). 1974. SEPARATION OF THE SUBSPECIES OF LARGEMOUTH BASS Micropterus salmoides salmoides, AND M. s. floridanus AND INTERGRADES BY USE OF MERISTIC CHARACTERS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 608-619.

Meristic variation was examined among samples of northern largemouth bass, Micropterus salmoides salmoides, from Arkansas and compared with variation found in samples of the Florida largemouth, Micropterus salmoides floridanus. Meristic characters employed in this investigation included five scale counts and number of pyloric caeca. Statistical analyses of the data involved analysis of variance, discriminant function analysis, and Hotelling's T^2 test statistic. The primary objective of this study was to establish the best criteria for the practical separation of the two subspecies and, if possible, their intergrades. Number of pyloric caeca, which had not been previously compared for these two subspecies, proved to be the best single character for their separation. Utilizing two scale characters and number of pyloric caeca, discriminant function analyses permit classification of unknown specimens to one or the other subspecies with a high degree of certainty. A graph, containing two overlapping ellipses, constructed using Hotelling's T^2 test statistic, enables a rapid classification of M. s. salmoides, M. s. floridanus, and possibly intergrades by plotting original values for number of lateral-line scales and number of pyloric caeca on the axes. (Auth.)

18991. Williams, George, Jr., Richard C. Simmonds, and John F. Boyd (Calhoun Community College, Decatur, Alabama 35601). 1975. EFFECTS OF THE ANTIMICROBIAL FURANACE ON Fundulus heteroclitus EMBRYOS. J. Fish. Res. Board Can., 32(1): 69-71.

Single, 1-h treatments of five stages of Fundulus heteroclitus embryos with Furanace solutions (2.0, 1.0, 0.5, and 0.25 ppm) resulted in no significant increase in either mortality or anomaly rates. We conclude that a 1-h treatment with Furanace may be safely used in the media supporting fertilized eggs. Chronic exposure of F. heteroclitus embryos in 2.0, 6.0, and 10.0 ppm solutions results in high mortality and anomaly rates. (Authors)

18992. Oseid, Donavon M., and Lloyd L. Smith, Jr. (Dept. of Entomol., Fish., and Wildl., Univ. of Minnesota, St. Paul, Minn. 55101). 1974. CHRONIC TOXICITY OF HYDROGEN SULFIDE TO Gammarus pseudolimnaeus. Trans. Amer. Fish. Soc., 103(4): 819-822.

Gammarus pseudolimnaeus from two trout streams were exposed to various levels of hydrogen sulfide from 0.0007 to 0.0192 mg/liter in a flow-through apparatus for periods of 65, 95, and 105 days in four tests. Results indicate that 0.002 mg/liter of H_2S in the maximum safe concentration for Gammarus, but below this level there is increased reproduction or survival. Mean 96-hr LC50 for Gammarus from the same populations was 0.022 mg/liter of H_2S or approximately 10 times the safe level. (Authors)

18993. Kilgen, Ronald H. (Dept. of Fish. and Allied Aquacultures, Auburn Univ., Agric. Exp. Sta., Auburn, Alabama 36830). 1974. FOOD HABITS OF WHITE AMUR, LARGEMOUTH BASS, BLUEGILL, AND REDEAR SUNFISH RECEIVING SUPPLEMENTAL FEED. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 620-624.

White amur effectively controlled dense growths of Mougeotia, Zygnema, and Eleocharis, when introduced into a pond containing a supplementally fed largemouth bass-bluegill-redear population. Analysis of stomach contents showed that white amur preferred plant foods (88% by volume), and probably ingested a few insects and crustaceans while "grazing" on plant materials. Largemouth bass preferred fish and other animals (64%), but also ate some supplemental feed (32%). Bluegill stomachs contained more supplemental feed (44%) than any other item, followed by insects and animal parts (28%), and plant parts (17%). Redears seemed to prefer insect larvae (42%), but also ate plant material (38%). White amur apparently did not compete with the sunfishes for either natural or supplementary food items. (Auth.)

18994. Wenner, Charles A., and John A. Musick (Virginia Inst. of Marine Sci., Gloucester Point, Virginia 23062). 1975. FOOD HABITS AND SEASONAL ABUNDANCE OF THE AMERICAN EEL, Anguilla rostrata, FROM THE LOWER CHESAPEAKE BAY. Chesapeake Science, 16(1): 62-66.

Food habits and seasonal abundance of the American eel, Anguilla rostrata (Lesueur), were studied from the brackish water regions of three Virginia rivers. Abundance in trawl surveys was related to water temperatures with fewer eels being caught during the colder months. Polychaetes, crustaceans and bivalves were the most important dietary items of A. rostrata in brackish water. There was much predation on the commercially important species Mya arenaria and Callinectes sapidus. (Authors)

18995. Walburg, Charles H. (U. S. Fish and Wildlife Service, North Central Res. Invest., Yankton, South Dakota 57078). 1975. FOOD OF YOUNG-OF-YEAR CHANNEL CATFISH IN LEWIS AND CLARK LAKE, A MISSOURI RIVER RESERVOIR. Amer. Midl. Nat., 93(1): 218-221.

Zooplankton and aquatic insects were the only foods found in the stomachs of age-0 channel catfish, Ictalurus punctatus, 15-90 mm long. Daphnia and Diaptomus made up almost the entire diet of postlarvae 15-20 mm long. Dipteran larvae and pupae became progressively more important as the size of the fish increased. (Auth.)

18996. Jones, A. Neville (Southwest Wales River Auth., Penyfai House, Llanelli, Wales, United Kingdom). 1975. A PRELIMINARY STUDY OF FISH SEGREGATION IN SALMON SPAWNING STREAMS. J. Fish Biol., 7(1): 95-104.

An electrofishing survey of the fish populations in three streams was carried out to study the different distribution of fish in riffles (shallow fast water), runs (intermediate depth) and pools (deep slow water). Each stream had an average daily flow of about 1.4 m^3/sec. The results indicated partial segregation of fish in the three kinds of habitat and that 0+ salmon, bullheads and lampreys predominated in riffles; 1+ salmon, 0+ trout and stoneloach predominated in riffles and runs; 1+ trout predominated in runs and pools; and that 2+ and older trout, minnows and gudgeon predominated in pools. The distribution of eels was not markedly different in the three kinds of habitat. The role of adaptation to environment and interactions are briefly discussed. The pectoral fin area of juvenile salmon is shown to be significantly greater than that of juvenile sea trout of known origin and it is suggested that this may be an adaptation to the faster flow of the riffle environment, the larger fins acting as a more efficient hydrofoil to hold the fish in station on the substratum. It is also suggested that the proportion of fish other than salmonids in the three streams is related to stream gradient and that the shallower the gradient the greater is the proportion of non-salmonid fish compared with salmonid fish. (Auth.)

18997. Dill, P. A., and R. C. Saunders (Dept. of Biol., St. Francis Xavier Univ., Antigonish, Nova Scotia B0H 1C0, Canada). 1974. RETARDED BEHAVIORAL DEVELOPMENT AND IMPAIRED BALANCE IN ATLANTIC SALMON (Salmo salar) ALEVINS HATCHED FROM GASTRULAE EXPOSED TO DDT. J. Fish. Res. Board Can., 31(12): 1936-1938.

Eggs of Atlantic salmon (Salmo salar) were subjected to 0.1, 0.05, 0.01, or 0.005 ppm DDT as gastrulation. Behavior of hatched fish was observed in DDT-free aquaria for about 30 days, and compared with that of controls. Exposure to the two higher concentrations of DDT retarded behavioral development and impaired balance. The consequences of such behavior changes to wild fish are discussed. (Authors)

18998. Hunt, Robert L. 1975. FOOD RELATIONS AND BEHAVIOR OF SALMONID FISHES. 6.1. USE OF TERRESTRIAL INVERTEBRATES AS FOOD BY SALMONIDS. From: "Coupling of Land and Water Systems" (Ecol. Studies, Vol. 10), A. D. Hasler, ed., Springer-Verlag, 175 5th Ave., N.Y., N.Y. 10010, pp. 137-151.

18999. Ellis, James E. (U.S. Fish & Wildl. Service, Fish Farming Development Center, P. O. Box 711, Rohwer, Arkansas 71666). 1974. SURVIVAL, GROWTH, AND FEED CONVERSION OF CHANNEL CATFISH AFTER ELECTRONARCOSIS. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 624-629.

Electrically narcotized and untreated lots of two-year-old channel catfish (Ictalurus punctatus) were held in divided cages in a pond to determine the effects of narcosis on their survival, growth, and feed conversion. Fish were narcotized by exposure to 1.5 volts/cm for 60 seconds duration with either 60 hertz alternating current, continuous direct current, or pulsed direct current of 15, 20, or 25 pulses/sec. There was no significant difference in survival, growth, or feed conversion between the treated and untreated lost at the 0.01 probability level. (Auth.)

19000. McCarthy, D. H., J. P. Stevenson, and M. S. Roberts (Fish Dis. Lab., Min. of Agric., Fish. and Food, Weymouth, England). 1975. SOME BLOOD PARAMETERS OF THE RAINBOW TROUT (Salmo gairdneri Richardson) II. THE SHASTA VARIETY. J. Fish Biol., 7(2): 215-219.

Some of the blood constituents of male, female and immature rainbow trout of the Shasta variety, maintained in known environmental and dietetic conditions, were examined and the results statistically treated. The parameters for male and female trout were similar, only the erythrocyte count exhibiting a significant difference. Large but expected differences were evident between the parameters for mature and immature fish. (Authors)

19001. Peterson, S. E., and R. M. Schutsky (Ichthyological Associates, Inc., P. O. Box 12, Drumore Pennsylvania 17518). 1975. TEMPERATURE TOLERANCE STUDIES ON FRESHWATER FISHES. Presented at the Northeast Fish and Wildlife Conf., Feb. 23-26, 1975, New Haven, Connecticut, 12 p.

Temperature preference, avoidance and tolerance studies were conducted on channel catfish (Ictalurus punctatus) and bluegill (Lepomis macrochirus) in Conowingo Pond, lower Susquehanna River. Results to date indicate that avoidance temperatures are useful in predicting short-term (48 hr) lethal temperatures. Mortality curves were determined for both species. Median resistance temperatures were compared with preference and avoidance temperatures. Preferred temperatures of the fishes (acclimated at 80 ± 1 F) were 9 and 15 F lower than the median resistance temperature. Fishes actively avoided temperatures which were lethal to them. For both species acclimated at 81 F the sub-lethal temperature was 95 F and incipient upper lethal was 96 F; total lethal was 98 F for channel catfish and 97 F for bluegill. Lethal temperatures were determined for a 48 hr exposure. Results of similar tests are also given for channel catfish and bluegill acclimated at 90 F. (Authors)

19002. Chen, Peter K., G. L. Bullock, H. M. Stuckey, and A. C. Bullock (Dept. of Biol., Georgetown Univ., Washington, D. C. 20007). 1974. SEROLOGICAL DIAGNOSIS OF CORYNEBACTERIAL KIDNEY DISEASE OF SALMONIDS. J. Fish. Res. Board Can., 31(12): 1939-1940.

An immunodiffusion test is described which provides a rapid, sensitive, and definitive diagnosis of corynebacterial kidney disease of salmonid fishes. Specific precipitin lines are formed within 24 h when rabbit antiserum is reacted with kidney disease cell suspensions or internal tissue homogenates containing the specific bacterium. No precipitin lines are formed with tissue homogenates from healthy fish or from those injected with other fish pathogenic bacteria. (Authors)

19003. Amend, Donald F. (Western Fish Disease Lab., Building 204, Naval Support Activity, Seattle, Washington 98115). 1974. INFECTIOUS HEMATOPOIETIC NECROSIS (IHN) VIRUS DISEASE. U.S. Dept. of the Interior, Fish and Wildlife Service, FDL-39 (supersedes FDL-14 and FDL-30), 6 p.

19004. Neproshin, A. Yu. (Inst. of Evolutionary Morphology and Animal Ecology, USSR Academy of Sciences, Moscow, USSR). 1974. THE ACOUSTIC BEHAVIOR OF SOME FAR EASTERN SALMON IN THE SPAWNING PERIOD. J. Ichthyol., 14(1): 154-157.

Salmon are pair-forming fish and, as a rule, the female spawns with one male. Such a phenomenon is also observed in other species of fishes. The forming of spawning pairs occurs shortly before spawning. It is at present difficult to say what factors influence the choice of the male by the female (or vice versa). Such factors undoubtedly exist and the most important of them is preparedness for the simultaneous commencement of spawning. It is assumed that the drumming sounds are the main signals by means of which this preparedness is defined. Their occurrence probably coincides with the commencement of the anadromous migration (drumming sounds are already recorded in the pink salmon off the estuary). It has been established that when fish form spawning pairs drumming sounds disappear from the "repertoire" of the salmon. Drumming sounds are subject to a strict diurnal cyclicity and reach their apogee before the spawning schools split up into pairs. Many years of observations on the bio-acoustic behavior of the sockeye and other salmon enable us to presume the existence of two stages in the period of anadromous migration of salmon, as well as to recommend the method of acoustic observation on the behavior of fishes in the course of their life and in particular in spawning. (From Auth.'s conclusions)

19005. Chubb, James C., J. W. Jones, and J. W. Banks (Dept. of Zool., Univ. of Liverpool, Liverpool, England). 1975. FILM AND TELEVISION IN FISHERY RESEARCH AT LLYN TEGID (BALA LAKE), WALES. J. Fish Biol., 7(2): 153-157.

19006. DiBenedetto, F. E., and A. Farmanfarmian (Dept. of Physiol., Rutgers Univ., New Brunswick, New Jersey 08903). 1975. INTESTINAL ABSORPTION OF NATURALLY OCCURRING SUGARS IN THE RAINBOW TROUT, Salmo gairdneri, UNDER FREE-SWIMMING CONDITIONS. Comp. Biochem. Physiol., 50(3A): 555-559.

An experimental procedure has been developed for measurement of intestinal nutrient absorption in the free-swimming trout. The surgical operation and the anesthetic (MS 222) do not affect the intestinal absorption of sugars in experiments of short (15 min) or long (90 min) duration. The rate of glucose absorption in μ moles/g tissue per hr from the midgut section of the digestive tract was 10.64 and from the pyloric caeca 4.14. The midgut is the region for active sugar absorption. At 20 mM concentration the absorption rates of glucose, galactose and mannose from the midgut were, respectively, 10.6, 6.7 and 1.9. Sugar transport mechanism of the trout has specific structural requirements. (Authors)

19007. Kwain, Wen-hwa (Ontario Min. of Nat. Resources, Fish and Wildl. Res. Branch, Sault Ste. Marie, Ontario, Canada). 1975. EMBRYONIC DEVELOPMENT, EARLY GROWTH, AND MERISTIC VARIATION IN RAINBOW TROUT (Salmo gairdneri) EXPOSED TO COMBINATIONS OF LIGHT INTENSITY AND TEMPERATURE. J. Fish. Res. Board Can., 32(3): 397-402.

Lowest mortality rates of rainbow trout (Salmo gairdneri) embryos were obtained at temperatures of 7 and 10 C and light intensities of 0.2 and 20 lx. Temperatures of 3 and 15 C and an intensity of 400 lx were near the thresholds for development. Eggs exposed to 0.2 lx required 111 days to reach 50% hatch at 3 C, but 26 days at 15 C; those exposed to 20 lx, 97 days at 3 C and 25 days at 15 C. Growth rates of rainbow trout 145 days after hatch were significantly different ($P < 0.05$) at 10 and 3 C, and 20, 2, and 0.2 lx. The fastest growth occurred at 10 C and 2 lx, and the lowest growth at 3 C and 0.2 lx. For increment of body weight it was about 23.8%/day of initial weight and 6.6% at 3 C. At light intensities of 20, 2, and 0.2 lx, the rate per day was 24.7, 17.2, and 11.2%, respectively. However, increases in length occurred at a much reduced rate. Variations in numbers of vertebrae, gill rakers, and fin rays were positively correlated with the embryonic development rate. Longer incubation periods were usually associated with more meristic elements, regardless of the environmental factors involved. (Auth.)

19008. Aldridge, Edmund C., III, and Harold A. Loyacano, Jr. (Clemson Univ., Clemson, South Carolina 29631). 1974. PARASITES FROM FISH COLLECTED IN PROXIMITY TO CATFISH CAGES. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 630-642.

An investigation was conducted to determine the effects of cage culturing channel catfish, Ictalurus punctatus (Rafinesque), on the native fish found in proximity to the cages. Monogenetic trematodes and copepods parasitizing fish collected were identified to genus. Nine genera of monogenetic trematodes and one genus of copepod were found. Comparisons were made between the number of fish parasitized at cage sites and control sites during three periods of time relative to catfish culture in cages. There were no significant differences between cage sites and control sites during any of the three periods. (Authors)

19009. Maciorowski, Anthony F. (Great Lakes Fish. Lab., U.S. Fish & Wildl. Serv., Ann Arbor, Michigan 48107). 1974. THE OCCURRENCE OF THE FRESHWATER BRYOZOAN Pottsiella erecta (Potts) 1884 (GYMNOLAEMATA: PALUDICELLIDAE) IN LAKE ERIE. Ohio Journal of Science, 74(4): 245-247.

The collection of Pottsiella erecta in western Lake Erie in August 1972 represents the first reported occurrence of this species in the Great Lakes and a 110 km northward extension of its known range. (Auth.)

19010. Wedemeyer, Gary A., and James W. Wood (Western Fish Dis. Lab., Seattle, Washington 98115). 1974. STRESS AS A PREDISPOSING FACTOR IN FISH DISEASES. U.S. Dept. of the Interior, Fish & Wildl. Service, FDL-38, 8 p.

19011. Novotny, Anthony J. (Northwest Fish. Center, NMFS, NOAA, 2725 Montlake Blvd. E., Seattle, Washington 98112). 1975. NET-PEN CULTURE OF PACIFIC SALMON IN MARINE WATERS. MFR Paper 1117 from Marine Fisheries Review, 37(1): 36-47. Copies available in limited number from D83, Technical Information Div., Environ. Sci. Information Center, NOAA, Washington, D.C. 20235).

The concept of floating net-pen culture of fishes in marine waters has been expanded to include Pacific salmon, Oncorhynchus spp., in the Pacific Northwest. The National Marine Fisheries Service initiated the research in Puget Sound, Wash., in 1969 with small (2.7 m^3) net enclosures. The rapid growth and reasonable survival of cultured coho salmon, O. kisutch, led to the development of a pilot farm. The farm utilized a surface area of 0.1 ha with four net pens totaling 7,080 m^3 in volume. A total of 61.4 metric tons (mt) of 170- to 380-g Pacific salmon were shipped to market within 18 mo after fertilization of the eggs. Coho salmon have been raised to maturity in seawater pens in 2- and 3-year cycles. Survival of both brood stocks and fertilized eggs from cultured salmon is variable, however, and improvement is needed in controlling disease and nutrition. Bacterial pathogens are a serious problem. A vaccine for the control of vibriosis, the most prevalent disease, appears to be successful but needs further study and evaluation. Net-pen culture is being practiced in Puget Sound waters for two purposes: (1) the commercial production of pan-sized Pacific salmon by private farms and (2) the extended rearing of hatchery-produced salmon for release to the local sport fishery. Total sales in early 1973 of privately farmed fish were over 40 mt and were expected to rise to 1,800 mt in 1974. (Auth.)

19012. Porter, T. R., and S. Corey (Lake Huron Res. Unit, Fish and Wildl. Res. Branch, Ontario Min. of Nat. Resources, Tehkummah, Ontario, Canada). 1974. A HERMAPHRODITIC LAKE WHITEFISH, Coregonus clupeaformis, FROM LAKE HURON. J. Fish. Res. Board Can., 31(12): 1944-1945.

A hermaphroditic lake whitefish, Coregonus clupeaformis, caught in Lake Huron is described. The specimen had a normal growth rate and had no apparent abnormal external characteristics. Both gonads were ovotestes. The ovarian and testicular portions appeared to be functional and developing normally. (Authors)

19013. Wolf, K., G. L. Bullock, and M. C. Quimby (Eastern Fish Dis. Lab., U.S. Dept. of the Interior, Fish and Wildl. Service, Kearneysville, West Virginia 25430). 1974. A SIMPLE METHOD FOR CLEANING AND RE-STERILIZING DISPOSABLE SEROLOGICAL PIPETTES. J. Appl. Bact., Vol. 37, pp. 447-450.

19014. Hoyt, Robert D. (Biol. Dept., Western Kentucky Univ., Bowling Green, Kentucky 42101). 1974. THE EFFECT OF STOCKING ON THE MERISTIC COMPLEMENT OF THE NEOSHO SMALLMOUTH BASS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 643-652.

Neosho smallmouth bass were collected from 1962-64 in tributaries of the Arkansas River in northwest Arkansas and southern Missouri. Counts were made of dorsal spines and soft-rays, anal spines and soft-rays, pectoral fin-rays and lateral-line scales. The data were compared with that for intergrade smallmouth from other drainages in Arkansas and with data given by Castro (1963) and Hubbs and Bailey (1940). Neosho smallmouth in this study had significantly higher mean counts than those reported in 1940. Each stream having higher counts had been stocked with the intergrade form of smallmouth from the White River in Arkansas. (Auth.)

19015. Weintraub, Matthew J., and R. Stuart Mackay (Dept. of Biol., Boston Univ., Boston, Massachusetts 02215). 1975. RESPIRATORY AND HEARTBEAT SYNCHRONY STUDIED BY TELEMETRY IN THE TROUT (Salmo gairdneri). Copeia No. 1, pp. 78-85.

Voltages associated with heartbeat and operculum movement were transmitted by radio from free swimming trout Salmo gairdneri. Synchrony between respiration and heartbeat was sometimes observed, the records usually being analyzed both in terms of preferred phase and transition probability between phases. Reasons for synchrony are discussed, and it is seen not to be a dominant effect in this fish. (Authors)

19016. Ward, James V. (Dept. of Zool and Entomol., Colorado State Univ., Fort Collins, Colorado 80521). 1974. A TEMPERATURE-STRESSED STREAM ECOSYSTEM BELOW A HYPOLIMNIAL RELEASE MOUNTAIN RESERVOIR. Arch. Hydrobiol., 74(2): 247-275.

Biological, chemical, and physical parameters were measured over a 12-month period at 4 sampling sites on the South Platte River below a Colorado mountain reservoir. Owing to the hypolimnial source, the stream temperature was higher than normal in winter, lower in summer, fluctuated less diurnally and seasonally, and exhibited a seasonally displaced maximum. These effects decreased downstream, but still altered the temperature pattern 8.5 km below the dam. The number of species of macroinvertebrates progressively increased downstream, and it is thought that the temperature regime is responsible for the low diversity by failing to stimulate various developmental stages of the life cycle or by seasonally altering developmental patterns. It is postulated that the river below the dam is a temperature-stressed ecosystem, and that this is the major reason for the low diversity and large standing crop of macroinvertebrates. (Auth.)

19017. Bryan, J. E. (Dept. of the Environ., Fish. and Mar. Service, Vancouver, British Columbia V6E 2P1, Canada). 1974. HUNGER AND THE CAPTURE OF GRAYLING AND CHAR. J. Fish. Res. Board Can., 31(12): 1945-1948.

Arctic grayling, Thymallus arcticus, and Arctic char, Salvelinus alpinus, were collected by angling and seining in remote areas of northern Yukon Territory. Stomach samples were observed to test the hypothesis that fish caught by angling had eaten less food than those caught by seining. The hypothesis was supported by the data for grayling. The data for char were consistent with the hypothesis, but the results were not statistically significant. There was no difference in the sex ratio of fish caught by the two methods. Angling selected larger char than did seining, but there was no evidence of size selection in grayling. (Auth.)

19018. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA, 78850 Thiverval-Grignon, France). 1974. ON THE USE OF MALACHITE GREEN IN THERAPEUTIC PISCICULTURE (Sur l'Utilisation du Vert de Malachite en Therapeutique Piscicole). Bull. Francais de Pisciculture, 254(3):16-17, Technical Note No. 0.4. In French.

19019. Landry, Andre M., Jr., and Kirk Strawn (NUS Corporation, 900 Gemini Ave., Houston, Texas 77058). 1974. NUMBER OF INDIVIDUALS AND INJURY RATES OF FISHES CAUGHT ON REVOLVING SCREENS AT THE P. H. ROBINSON GENERATING STATION. Reprint: Proc. 2nd Entrainment and Intake Screening Workshop, L. D. Jensen (ed.). The Johns Hopkins Univ. Cooling Water Research Project, Report No. 15, pp. 263-271.

19020. Fox, Jackson L., and Michael S. Moyer (208 A.P. Black Hall, Dept. of Environ. Engineering Sciences, Univ. of Florida, Gainesville, Florida 32611). 1975. EFFECT OF POWER PLANT CHLORINATION ON ESTUARINE PRODUCTIVITY. Chesapeake Science, 16(1): 66-68.

Power plants chlorinate their cooling waters to prevent biological fouling of condenser tube walls. We studied the effects of chlorine on in situ net primary production in the discharge waters of a power plant at Crystal River, Florida. Primary production values decreased an average of 57% due to plant passage and chlorination. In the absence of chlorine, the average decrease was 13%. (Authors)

19021. Huckabee, J. W., and N. A. Griffith (Environ. Sci. Div., Oak Ridge Nat. Lab., Oak Ridge, Tennessee). 1974. TOXICITY OF MERCURY AND SELENIUM TO THE EGGS OF CARP (Cyprinus carpio). Trans. Amer. Fish. Soc., 103(4): 822-824.

Antagonistic interactions of mercury and selenium have been demonstrated in vivo, but interactions under environmental conditions that might affect the toxicity of either element have not. We exposed carp eggs to trace amounts of mercury and selenium to test for an effect on hatchability. Test concentrations of Hg(II) (from $HgCl_2$) and SeO_3^{2-} (from SeO_2) were 1, 2, 3, 4, and 5 μg/g each, and each possible combination of these concentrations. No eggs hatched when incubated in ≥ 4 μg/g Hg(II), but up to 5 μg/g SeO_3^{2-} had no effect on hatchability. (Authors)

19022. Demski, Leo S., Diana H. Bauer, and Jerry W. Gerald (Depts. of Anat. and Biol., The Univ. of New Mexico School of Medicine, Albuquerque, New Mexico 87131). 1975. SPERM RELEASE EVOKED BY ELECTRICAL STIMULATION OF THE FISH BRAIN: A FUNCTIONAL-ANATOMICAL STUDY. J. Exp. Zool., 191(2): 215-232.

Acute brain stimulation experiments were carried out in anesthetized male green sunfish, Lepomis cyanellus. Semen discharge was evoked consistently by low level electrical stimulation (100 μA or less) in the following areas: the preoptic region, dorsal hypothalamus, thalamus, midbrain tegmentum and the basolateral midbrain and medulla. Areas which were stimulated repeatedly at 100 μA and were always negative for sperm release included: the telencephalon with the exception of the preoptic region, the optic tectum, the cerebellum, the inferior lobe of the hypothalamus, the nucleus rotundus and the dorsal medulla. Removal of most of the optic tectum and cerebellum failed to block responses evoked from the preoptic area; however, they were usually eliminated by transecting the rostral spinal cord. Electrical stimulation of an isolated 4 mm segment of spinal cord located at the third vertebral level resulted in sperm release, indicating that adequate mechanisms for semen discharge are present within the upper spinal cord. The results of this study suggest that a sperm release system in the green sunfish extends from the preoptic area to the spinal cord passing through the hypothalamus, midbrain tegmentum and basal midbrain and medulla. (Authors)

19023. Newcomb, T. W. (Northwest Fish. Center, NMFS, NOAA, Seattle, Washington 98112). 1974. CHANGES IN BLOOD CHEMISTRY OF JUVENILE STEELHEAD TROUT, Salmo gairdneri, FOLLOWING SUBLETHAL EXPOSURE TO NITROGEN SUPERSATURATION. J. Fish. Res. Board Can., 31(12): 1953-1957.

Groups of juvenile steelhead trout (Salmo gairdneri) were exposed for 35 days to various (103, 105, 110, and 116%) sublethal nitrogen plus argon saturations. Pooled serum samples were analyzed for Ca, Na, PO_4, K, Cl, albumin, total protein, cholesterol, alkaline phosphatase, glucose, urea, uric acid, total bilirubin, lactate dehydrogenase, and serum glutamic oxalacetic transaminase. An increase in serum potassium and phosphate, and a decline in serum albumin, calcium, cholesterol, total protein and alkaline phosphatase were noted in steelhead exposed to 116% nitrogen (N_2 + Ar) saturation (total atmospheric gas saturation 110%). No major changes in blood chemistry were observed at nitrogen saturations of 110% or less. (Auth.)

19024. Jackson, P. B. N. (The J. L. B. Smith Inst. of Ichthyology, Rhodes Univ., Grahamstown, South Africa). 1974. COMMON AND SCIENTIFIC NAMES OF FRESHWATER FISHES OF SOUTHERN AFRICA. Piscator, No. 90, pp. 36-50.

19025. Kjelson, Martin A., and George N. Johnson (NMFS, Atlantic Estuarine Fish. Center, Beaufort, North Carolina 28516). 1974. DESCRIPTION AND EVALUATION OF A PORTABLE DROP-NET FOR SAMPLING NEKTON POPULATIONS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 653-662.

An improved design of a portable drop-net is presented. The drop-net was used to sample estuarine nekton populations whose densities were later determined by the DeLury regression method. The drop-net samples provided mean density estimates that were 4-33% of the DeLury estimate for pelagic fishes. 50-100% for semi-demersal and demersal fishes, and 82-100% for macrocrustaceans (crabs and shrimp). The degree of variation between drop-net samples depended on the species, with the greatest variation seen in samples of pelagic fishes. We concluded that there were no important differences in density estimates from day-night drop-net samples. (Authors)

19026. Bengtsson, Bengt-Erik (The Nat. Environ. Prot. Board, Brackish Water Toxicol. Lab., Studsvik S-611-01, Nykoping, Sweden). 1974. THE EFFECT OF ZINC ON THE ABILITY OF THE MINNOW, Phoxinus phoxinus L., TO COMPENSATE FOR TORQUE IN A ROTATING WATER-CURRENT. Bull. Environ. Contamin. Toxicol., 12(6): 654-658.

19027. Arnold, G. P., and P. B. N. Nuttall-Smith (Fish. Lab., Lowestoft, Suffolk, England). 1974. SHADOW CINEMATOGRAPHY OF FISH LARVAE. Marine Biology, 28(1): 51-53.

A simple system of shadow cinematography, consisting of a small tungsten halogen lamp, 2 large biconvex lenses and a 16 mm camera, is described for recording the swimming and feeding behaviour of larval fish. The system can be used either with infra-red film to record swimming behaviour independently of ambient light intensity, or with high-resolution film to record food organisms and feeding behaviour. Small plankton organisms of 0.2 mm width can be resolved using high-resolution film. The technique has been used to record the behaviour of plaice larvae (Pleuronectes platessa L.) feeding on the nauplii of Artemia salina L. The perceptive field of the larvae extends to approximately ± 60° in azimuth, ± 40° in elevation and 1.5 body lengths in range. (Authors)

19028. Sun, L. T., and M. L. Gorman. 1973. THE TOXICITY TO FISH OF HERBICIDES RECOMMENDED FOR WEED CONTROL IN THE REWA. Fiji Agric. Journal, 35(1): 31-33; Weed Abstracts, 23(9): abstract 1997.

Reservations as to possible toxicological hazards to the Rewa River resulting from the use of a copper sulphate + bipyridyl mixture, an effective treatment for water weed control in that area, prompted tests on the toxicity of one such mixture to fish. In tests with Poecilia mexicana in a static water system LC_{50}'s of 1.42 and 12.53 ppm were established for copper sulphate and paraquat, respectively, while LT_{50}'s (time required for 50% of a population to be killed by a given concn.) of 1.4, 2 and 3 ppm of a 4:1 copper sulphate + paraquat mixture were 18.5, 11 and 7.5 (h), respectively. It was concluded that in view of the high toxicity of the copper component spraying should be carried out only when absolutely necessary and then only small areas should be treated with sufficient time allowed between sprayings to enable the copper salts to be thoroughly flushed out to the sea.

19029. Johnson, G. R., G. Wobeser, and B. T. Rouse (Dept. of Vet. Pathology, Western Coll. of Vet. Medicine, Univ. of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada). 1974. INDIRECT FLUORESCENT ANTIBODY TECHNIQUE FOR DETECTION OF RM BACTERIUM OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Board Can., 31(12): 1957-1959.

An indirect fluorescent antibody technique was evaluated as a method for the rapid detection of RM bacterium of rainbow trout (Salmo gairdneri). Antibody produced by inoculating rabbits with washed RM bacterium antigen was combined with commercially prepared fluorescein-labelled antiglobulin. The technique demonstrated strong specificity for the RM bacterium in washed and broth cultures, and in kidney smears from experimentally infected rainbow trout. (Authors)

19030. Kruger, Andrzej (Inst. Rybactwa Srodladowe go w Olsztynie, Zaklad Gospodarki Stawowej, Poland). 1973. APPLICATION OF ^{125}J FOR LABELLING YOUNG EEL. (Zastosowanie ^{125}J do Znakowania Wegorza Obsadowego). Roczniki Nauk Rolniczych, 95(3): 69-90. In Polish.

Subsequent verification of a method for labelling eels using iodine radionucleides developed by the author. Young eels were labelled using low-energetic and persistent ^{125}J. In the basic investigations, the persistence of labelling by the method and the distribution of radioactive contamination was determined. Autoradiographical tests were performed as well. Finally, the author endeavoured to determine the intensity of metabolism by comparative studies. (Synopsis)

19031. Dechtiar, Alex O., and William A. Dillon (Fish and Wildl. Res. Branch, Ont. Min. of Nat. Resources, Maple, Ontario, Canada). 1974. REDESCRIPTION OF Anonchohaptor anomalum Mueller 1938 AND A DESCRIPTION OF Icelanonchohaptor fyviei n. sp. (MONOGENOIDEA: DACTYLOGYRIDAE). J. Fish. Res. Board Can., 31(12): 1863-1866.

Icelanonchohaptor fyviei n. sp. from the gills of quillback, Carpiodes cyprinus (LeSueur), is described and Anonchohaptor anomalum Mueller 1938 is redescribed. A new host record, longnose sucker, Catostomus catostomus (Forster), is reported for Anonchohaptor anomalum Mueller 1938. (Authors)

19032. Levings, C. D. (Inst. of Oceanogr., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1974. SEASONAL CHANGES IN FEEDING AND PARTICLE SELECTION BY WINTER FLOUNDER (Pseudopleuronectes americanus). Trans. Amer. Fish. Soc., 103(4): 828-832.

The mean weight of food items from winter flounder (Pseudopleuronectes americanus) at St. Margaret's Bay, Nova Scotia closely coincided with the mean weight of benthic prey potentially available. Flounder larger than the mean length (29 cm) ate heavier particles. Small particles were consistently disregarded. There were seasonal changes in the weights of food items used and in the proportion of organisms to detritus in stomachs. (Auth.)

19033. Wegener, William, Dennis Holcomb, and Vincent Williams (Fish. Div., Florida Game and Fresh Water Fish Comm., 207 Carroll St., Kissimmee, Florida). 1974. SAMPLING SHALLOW WATER FISH POPULATIONS USING THE WEGENER RING. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 663-673.

The Wegener Ring was designed to sample fish populations of shallow, vegetated habitats in Lake Tohopekaliga, Florida. The sampler is portable and simple to use. Ten transects in water 0-18 inches deep were sampled within consecutive 3 inch contours. As depth of water increased, non-centrarchid forage fish decreased while numbers of centrarchids increased. Total numbers of fish decreased from an average of 216,042 per acre in 0-3 inches to 20,326 per acre in 15-18 inches of water. Standing crop was relatively constant, averaging 91 pounds per acre for all water depths. The monetary values per acre based on the fishery ranged from $6,511 in 0-3 inches to $2,524 in 15-18 inches of water. The average value per acre for water 0-18 inches deep was $3,788. (Authors)

19034. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA, 78850 Thiverval-Grignon, France). 1974. ON THE USE OF FORMALDEHYDE IN THERAPEUTIC PISCICULTURE. (Sur l'Utilisation du Formol en Therapeutique Piscicole). Bull. Francais de Pisciculture, 254(3): 18-19, Technical Note No. 0.5. In French.

19035. Morgan, Raymond P., II (Univ. of Maryland, Center for Environ. and Estuarine Studies, Chesapeake Biol. Lab., Solomons, Maryland 20688). 1975. DISTINGUISHING LARVAL WHITE PERCH AND STRIPED BASS BY ELECTROPHORESIS. Chesapeake Science, 16(1): 68-70.

Larval white perch, Morone americana, and larval striped bass, M. saxatilis, are difficult to distinguish morphologically in the size range 8 mm to 20 mm total length. Column acrylamide electrophoresis of the proteins produced three major bands for white perch and two major bands for striped bass. (Auth.)

19036. Fletcher, G. L., E. G. Watts, and M. J. King (Marine Sciences Res. Lab., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1975. COPPER, ZINC, AND TOTAL PROTEIN LEVELS IN THE PLASMA OF SOCKEYE SALMON (Oncorhynchus nerka) DURING THEIR SPAWNING MIGRATION. J. Fish. Res. Board Can., 32(1): 78-82.

Concentrations of copper, zinc, and total protein were measured in the plasma of sockeye salmon (Oncorhynchus nerka) during their migration to the Chilko spawning grounds, British Columbia. Concentrations of both metals and total protein declined during migration. Final values for all three parameters were 20-50% of those observed in seawater animals. Concentrations of zinc and copper were positively correlated with plasma protein concentrations. An examination of the metal: protein ratios revealed that only the zinc:protein ratios declined during migration, suggesting that zinc was being removed from the plasma independent of the proteins. (Authors)

19037. Moore, J. W. (School of Biol. Sci., Univ. of Bath, Bath, Somerset, England). 1975. REPRODUCTIVE BIOLOGY OF ANADROMOUS ARCTIC CHAR, Salvelinus alpinus (L.), IN THE CUMBERLAND SOUND AREA OF BAFFIN ISLAND. J. Fish Biol., 7(2): 143-151.

19038. McKeown, B. A., J. F. Leatherland, and T. M. John (Dept. of Zool., Coll. of Biol. Sci., Univ. of Guelph, Guelph, Ontario, Canada). 1975. THE EFFECT OF GROWTH HORMONE AND PROLACTIN ON THE MOBILIZATION OF FREE FATTY ACIDS AND GLUCOSE IN THE KOKANEE SALMON, Oncorhynchus nerka. Comp. Biochem. Physiol., 50(3B): 425-430.

Three experiments were undertaken to investigate the involvement of growth hormone and prolactin in the mobilization of lipids and carbohydrates in kokanee salmon. Deprivation of food caused a drop in plasma free fatty acids (FFA), liver glycogen and muscle water content. Enforced exercise for a period of 24 hr caused a rise in plasma growth hormone and prolactin. Injections of growth hormone or prolactin caused a rise in muscle FFA and a decrease in muscle water content. (Authors)

19039. Martin, F. Douglas, and James W. Patus (Radioecology Div., Puerto Rico Nuclear Center, Mayaguez, Puerto Rico 00708). 1974. A COMPARISON OF FISH FAUNAS IN A HIGHLY STRESSED AND A LESS STRESSED TROPICAL BAY - GUAYANILLA AND JOBOS BAY, PUERTO RICO. Proc. 27th. Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 675-688.

Jobos and Guayanilla Bays are semi-enclosed bays on the south coast of Puerto Rico. Jobos Bay receives some small amounts of raw sewage from two small villages and some wastes from a sugar central. Guayanilla Bay receives some sewage from a town on one shore, hydrocarbon, heavy metals, and carbohydrate addition from a petrochemical complex, and heat from an electrical power generating plant. Species diversity as indicated by the Shannon-Weaver index is higher in Jobos but the lowest values found in either bay are higher than these reported for normal temperature aquatic systems. Numbers of fish species are high (198 for Jobos and 93 for Guayanilla). The greatest similarity between the two bays is between Jobos Inner Bay which is turbid and receives some raw sewage and Guayanilla Thermal Cove which receives heated effluents up to 40°C (s=.526). (Authors)

19040. Meyer, Fred P. (Fish Farming Experimental Sta., P. O. Box 860, Stuttgart, Arkansas 72160). 1974. PARASITES OF FRESHWATER FISHES; II, PROTOZOA. 3. Ichthyophthirius multifiliis. U. S. Dept. of the Interior, Fish and Wildlife Service, FDL-2, 5 p.

19041. Davis, John C., and Richard A. W. Hoos (Dept. of the Environ., Fish. and Mar. Serv., Pacific Environ. Inst., West Vancouver, British Columbia V7V 1N6, Canada). 1975. USE OF SODIUM PENTACHLOROPHENATE AND DEHYDROABIETIC ACID AS REFERENCE TOXICANTS FOR SALMONID BIOASSAYS. J. Fish. Res. Board Can., 32(3): 411-416.

Results of an interlaboratory bioassay standardization exercise involving seven independent fish bioassay laboratories in British Columbia are presented. Toxicity of standard solutions of sodium pentachlorophenate and dehydroabietic acid was determined in freshwater static bioassays with underyearling rainbow trout (Salmo gairdneri), coho salmon (Oncorhynchus kisutch), and sockeye (Oncorhynchus nerka) salmon. Reported LC50s for the three species ranged from 37 to 130 ppb for sodium pentachlorophenate and 1.03-2.14 ppm for dehydroabietic acid. In general, test results for individual species and toxicants were fairly consistent and major disparities could be explained in some instances by variations in physical and chemical characteristics of the bioassay such as water temperature, hardness, or pH. Fish size and condition factor appeared to have little effect on apparent toxicity over the ranges tested. The usefulness of reference toxicants for standardizing bioassays is emphasized and suggestions are made for improved test procedures and increasing accuracy of results. Guidelines for toxicity tests should include the use of reference toxicants as a means of standardizing bioassay results. (Authors)

19042. Wolf, Ken (Eastern Fish Disease Lab., Route 1, Box 17A, Kearneysville, West Virginia 25430). 1974. RHABDOVIRUS DISEASE OF NORTHERN PIKE FRY. U. S. Dept. of the Interior, Fish and Wildlife Service, FDL-37, 4 p.

19043. Potter, Loren, David Kidd, and Donald Standiford (The Univ. of New Mexico, Albuquerque, New Mexico 87131). 1975. MERCURY LEVELS IN LAKE POWELL. BIOAMPLIFICATION OF MERCURY IN MAN-MADE DESERT RESERVOIR. Environ. Sci. Technol., 9(1): 41-46.

Flameless atomic absorption analyses of samples from Lake Powell yield mean mercury levels in ppb of 0.01 in water, 30 in bottom sediments, 10 in shoreline substrates, 34 in plant leaves, 145 in plant debris, 28 in algae, 10 in crayfish, and 232 in fish muscle. Trout were unique in having lower concentrations in muscle than in highly vascularized blood tissues. Concentrations increased with increased body weight and higher levels on the food chain. Muscle of some large fish over 2 kg whole body weight exceeded 500 ppb. Bioamplification of mercury up the food chain and association of mercury with organic matter are demonstrated. (Authors)

19044. Murray, Derek A. J. (Dept. of the Environ., Fish. and Mar. Serv., Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1975. TRACE ANALYSIS OF PHENOLS IN WATER BY GAS CHROMATOGRAPHY. J. Fish. Res. Board Can., 32(2): 292-294.

A method for analysis of low concentrations of phenols, cresols, and xylenols in water samples was developed. O-xylene was added to the sample as an internal standard and the sample was extracted once with chloroform to remove a portion of the total organic material present. The trimethylsilyl derivatives of the phenols were formed and analysis completed by gas chromatography. The method was rapid and required a minimum of sample manipulation. The lower limit of detection was 0.100 mg/liter for phenol, 0.025 mg/liter for cresols, and 0.050 mg/liter for xylenols. (Auth.)

19045. Perna, Aldo (Istituto Sperimentale per L'Igiene, Ed il Controllo Veterinario Della Pesca, Via R. Paolucci, 65100 Pescara, Italy). 1974. SEARCH OF FACTORS INHIBITING THE BACTERIAL GROWTH IN SOME TROUT FEEDS AND IN ORGANS AND TISSUES OF FISH RECEIVING SUCH FEEDS (Ricerca di sostanze inibenti lo sviluppo batterico in alcuni mangimi per trote ed in organi e tessuti di pesci con essi alimentati). Riv. It. Piscic. Ittiop, 9(4): 103-107.

The microbial method can be used to detect factors with antibacterial power in trout feeds. Ten samples of trout and five samples of trout feeds were so investigated. Traces of factors with antibacterial effects have been found in one commercial feed sample (which was medicated with 3,500 mg/Kg pellets of furazolidone) and in three trout samples. Doubtful issues were obtained in the remaining trout feeds and organ samples (liver, kidney, stomach contents), where small inhibiting halos were observed and considered as due to natural inhibiting factors. In effect, fish meal and organs (liver, kidney, stomach contents) of trout, which received no medicated feeds, resulted in having a natural inhibiting power which could slightly interfere with the results.

19046. Schubel, J. R., A. H. Auld, and G. M. Schmidt (Chesapeake Bay Inst., The Johns Hopkins Univ., Baltimore, Maryland 21218). 1974. EFFECTS OF SUSPENDED SEDIMENT ON THE DEVELOPMENT AND HATCHING SUCCESS OF YELLOW PERCH AND STRIPED BASS EGGS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 689-694.

Yellow perch and striped bass eggs were incubated in suspensions of different concentrations of natural, fine-grained sediments. The results showed that in the laboratory concentrations of up to 500 mg/l did not significantly affect the hatching success of yellow perch or striped bass eggs, but that concentrations of 1000 mg/l did significantly affect their hatching success. (Authors)

19047. Johansson, N., and J. E. Kihlström (Inst. of Zoophysiol., Box 560, S-751 22 Uppsala, Sweden). 1975. PIKES (Esox lucius L.) SHOWN TO BE AFFECTED BY LOW pH VALUES DURING FIRST WEEKS AFTER HATCHING. Environ. Research, 9(1): 12-17.

Newly hatched pike (Esox lucius L.) sac fry from artificially fertilized eggs were reared for eight days in water solutions with different pH values. At pH 6.8 the mortality was 17%, 26% at pH 5.0, and 97% at pH 4.2. (Authors)

19048. Booke, H. E. (Wisconsin Coop. Fish. Unit, Coll. of Nat. Resources, Univ. of Wisconsin, Stevens Point, Wis. 54481). 1975. CYTOTAXONOMY OF THE SALMONID FISH Stenodus leucichthys. J. Fish. Res. Board Can., 32(2): 295-296.

The karyotype for the coregonine fish Stenodus leucichthys (determined from squashed blastula preparations) has a diploid number of 74, consisting of 20 metacentric, 14 submetacentric, and 40 acrocentric chromosomes and a total arm number of 108. This karyotype is very similar to that of Coregonus clupeaformis. Stenodus was probably derived from Coregonus by means of Robertsonian translocations during the early stage of coregonine evolution. (Auth.)

19049. Andrews, Austin K., and Stephen A. Flickinger (Colorado Coop. Fish. Unit, Colorado State Univ., Fort Collins, Colorado 80521). 1974. SPAWNING REQUIREMENTS AND CHARACTERISTICS OF THE FATHEAD MINNOW. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 759-766.

New information concerning spawning and reproduction of the fathead minnow (Pimephales promelas Rafinesque) from observations in Colorado, and a review of important findings of previous works is presented in this paper. Potential for egg production by mature, Age I females is between 1,000 and 10,000 eggs per breeding season. On the basis of this information and the known polygynous mating behavior, we estimate that 19,200 adult fathead minnows in a ratio of five females per male should be stocked per surface acre to yield a theoretical maximum production of 1.5 million fingerlings per surface acre under intensive-culture conditions. Spawning usually starts in May with exact timing of initial spawning apparently controlled by day length but influenced by many factors. In one fathead minnow population in Colorado water temperature at the time of the first observed spawns was 1.6 C lower than had been reported by previous investigators. (Authors)

19050. Forshage, Allen, and Neil E. Carter (Texas Parks and Wildlife Dept., Fort Worth, Texas 76107). 1974. EFFECTS OF GRAVEL DREDGING ON THE BRAZOS RIVER. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 695-709.

A study of the physicochemical and biological conditions of the Brazos River in Hood and Somervell Counties, Texas to determine the effects of a gravel dredging operation on river fauna was made in 1971-73. Physical damages resulting from dredging caused a change intthe river course, depth, and substrate. Turbidity and settleable solids were increased. Alkalinity varied significantly (0.05 level) at the dredging site when gravel was taken from the river and processed. Dredging was responsible for major changes in benthic macroinvertebrate populations and fish populations in the immediate area of activity as well as in areas further downstream. (Authors)

19051. Naik, I. U. 1972. INTRODUCING GRASS CARP (Ctenopharyngodon idellus Cuvier and Valenciennes) IN PAKISTAN. Pakistan Journal of Science, 24(1/2): 45-52; Weed Abstracts, 23(10) abstract 2242, 1974.

Halaji Lake is overgrown with aquatic weeds to such an extent that the lake is in danger of silting up and of becoming incapable of supporting fish life. In 1965, 350,000 fish (mostly grass carp) 6 inches long were stocked in the 4180-acre lake and in June 1967 a further 30,000 fish weighing 200 g each were introduced. The fish avoided fibrous weeds such as Typha sp. and fed on soft weeds, preferring Potamogeton sp. to Hydrilla and Vallisneria spp. The stocking rate was insufficient to control weeds.

19052. Pandey, S., and N. Stacey (Dept. of Zool., Univ. of British Columbia, Vancouver, British Columbia V6T 1W5, Canada). 1975. ANTIESTROGENIC ACTION OF CLOMIPHENE CITRATE IN GOLDFISH. Can. J. Zool., 53(1): 102-103.

Hypophysectomized goldfish with regressed ovaries were injected with clomiphene citrate. No vitellogenesis was induced in the regressed ovaries. This indicates that clomiphene may be antiestrogenic in goldfish as far as induction of vitellogenesis is concerned. (Authors)

19053. Laird, Lindsay M., Ronald J. Roberts, W. M. Shearer, and J. F. McArdle (Freshwater Fish. Unit, Univ. of Liverpool, Liverpool, England). 1975. FREEZE BRANDING OF JUVENILE SALMON. J. Fish Biol., 7(2): 167-171.

Freeze branding using liquid nitrogen as a coolant was carried out on salmon parr and a sequential histopathological study was carried out for 16 weeks. The initial darkening of the brand area was due to destruction of melanophore control but the later, more diffuse, pattern was related to the invasion of the area of the stratum spongiosum and hypodermis by melanin containing cells such as are commonly found in healing teleost wounds. The traumatic damage was completely resolved well before the end of the experiment, suggesting that freeze branding is a particularly suitable short term batch marking method. (Authors)

19054. Ke, P. J., and R. G. Ackman (Dept. of the Environ., Fisheries and Marine Service, Halifax Lab., Halifax, Nova Scotia B3J 2R3, Canada). 1975. INHIBITION OF FORMATION OF FREE FATTY ACIDS IN COD LIVER WITH SODIUM HYPOCHLORITE SOLUTION (JAVEX). J. Fish. Res. Board Can., 32(2): 297-300.

Inexpensive active chlorine from commercially available Javex has been investigated for the preservation of cod livers at room temperature. Both homogenized and chopped liver samples were treated with preservative solution containing active chlorine concentrations of from 0.01 to 1.35%. After 7 days the formation of free fatty acids in cod livers by hydrolysis of lipids was inhibited by as much as 82 and 72%, respectively, for homogenized and chopped livers. Autolysis was effectively reduced by increasing the concentration of active chlorine, but accelerated markedly after a 10-day storage period. The peroxide value increased slowly in the liver treated with active chlorine solution (0.79%) from 0 to 3.2 meq/kg in a 7-day period and then reached 6.0 after 12 days of storage. About one-half of vitamin A content in the livers was destroyed during a 7-day treatment, but only 24% of vitamin D was lost. Since synthetic vitamin A can be cheaply added to the oil, these results show that active chlorine can be used as a cheap preservative in the fish liver industry, and provide a basis for the development of multiple component preservatives for livers. (Authors)

19055. Herricks, Edwin E., and John Cairns, Jr. (Aquatic Environ. Sciences, Union Carbide Corp., Tarrytown, New York 10591). 1974. THE RECOVERY OF STREAMS STRESSED BY ACID COAL MINE DRAINAGE. From: Fifth symposium on coal mine drainage research, Coal and the Environ. Tech. Conf., Oct. 22-25, 1974, pp. 11-24.

19056. White, Charles J., and William S. Perret (Louisiana Wild Life and Fish. Comm., New Orleans, Louisiana). 1974. SHORT TERM EFFECTS OF THE TOLEDO BEND PROJECT ON SABINE LAKE, LOUISIANA. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 710-721.

Hydrological and biological parameters are presented for Sabine Lake, Louisiana, before and after the completion of Toledo Bend Reservoir. Salinity and temperature regimens, species composition, and abundance are presented for June 1967 through May 1969. Selected species are compared to decreasing and increasing reservoir discharges. Occurrence and abundance of marine animals are related to altered salinity levels demonstrating possible effects on the total marine animal community. Commercial Penaeid shrimp landings from Sabine Lake for 1962 through 1971 are presented and discussed. (Authors)

19057. Merriner, John V. (Dept. of Zool., North Carolina State Univ., Raleigh, N. C. 27607). 1975. FOOD HABITS OF THE WEAKFISH, Cynoscion regalis, IN NORTH CAROLINA WATERS. Chesapeake Science, 16(1): 74-76.

The dominant food items in 817 stomachs of weakfish collected in North Carolina waters from 1967 to 1970 were penaeid and mysid shrimps, anchovies, and clupeid fishes. Dominance of various food items shifted depending upon the technique used to describe food habits: percent occurrence, percent number, or percent volume. Age 0 weakfish fed primarily on shrimp and anchovy. In Age I fish, shrimp and anchovy continued to dominate the food. Importance of shrimp in the diet decreased from Age II on. Older weakfish fed upon the clupeid species. (Auth.)

19058. Eales, J. G., and Janet M. Collicutt (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1974. UPTAKE OF AMBIENT RADIOACTIVE L-THYROXINE AND 3, 5, 3'-TRIIODO-L-THYRONINE BY RAINBOW TROUT, Salmo gairdneri (Richardson). Gen. Comp. Endocrinol., 24(4): 347-351.

Uptakes of ambient radioactive L-thyroxine ($^{*}T_4$) and 3, 5, 3'-triiodo-L-thyronine ($^{*}T_3$) at carrier levels of 10 μg/100 ml water were compared over 24 hr in starved 1-yr-old rainbow trout at 12°. Both $^{*}T_3$ and $^{*}T_4$ entered the plasma, attaining plasma radiohormone/water radiohormone (P/W) ratios of 0.44 and 0.45, respectively, at 24 hr. Plasma uptake patterns differed slightly for the two iodothyronines, and the average P/W value over 24 hr was 12.8% greater for the $^{*}T_4$-treated fish. Absorbed $^{*}T_3$ was excreted more extensively in the bile than $^{*}T_4$, but $^{*}T_3$ was less prone to deiodination. The slightly greater uptake of $^{*}T_3$ by certain tissues during the first 12 hr may be partly due to more rapid initial uptake of $^{*}T_3$ from the water. (Authors)

19059. Misra, R. K. (Dept. of Zool., Univ. of Western Ontario, London, Ontario N6A 3K7, Canada). 1975. HYBRIDIZATION IN SUNFISHES (Lepomis, CENTRARCHIDAE) BASED ON TIME-GROWTH AND STATIC ALLOMETRY. J. Fish. Res. Board Can., 32(1): 88-91.

A statistical method of analyzing for hybridization based on exponential growth curves is presented. It is pointed out that with "truly cross-sectional data" such as those on the sunfishes (genus Lepomis) reported here, it is possible to analyze for hybridization based on static variations separately from that based on the average growths of populations. The technique of statistical linear comparisons is extended to analyze for the degree of intermediacy of the hybrids as an alternative to the hybrid index approach. Applications of the statistical method of analyzing for hybridization based on the constants of exponential curves and of the method based on static allometry are shown on a real set of data for the first time. (Auth.)

19060. Tsai, Shan-Ching, G. Mallory Boush, and Fumio Matsumura (Dept. of Entomol., Univ. of Wisconsin, Madison, Wis. 53706). 1975. IMPORTANCE OF WATER pH IN ACCUMULATION OF INORGANIC MERCURY IN FISH. Bull. Environ. Contamin. Toxicol., 13(1): 188-193.

19061. Hanson, Willis D. (Missouri Dept. of Conservation, Columbia, Missouri). 1974. THE FISHERY OF A MISSOURI RESERVOIR RECEIVING THERMAL EFFLUENT. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 722-734.

Thomas Hill Reservoir, built by the Associated Electric Cooperative, is located in north central Missouri in a soft coal strip-mine area. Its waters provide cooling for a steam-powered electric generating plant. Fishing pressure averaged 18.2 hours per acre per year during the study. There was a yearly average of 4.9 fishing trips per acre. Anglers averaged 3.9 fish per trip. The average yearly harvest was 21.7 fish, or 13.5 pounds per acre. About 37 percent of all fish caught were taken in the warm-water discharge area mostly during winter. The relationships between angler use, angler success, and fishing pressure and the annual average Secchi disk reading were an important finding of this study. Linear correlations calculated for these parameters were significant to the five percent level (95 percent confidence). Another important finding of this study was that white crappies were stockpiled during 1969 and 1970, the years of very turbid water conditions, which greatly increased the catch in 1971 and 1972 when the water cleared. The winter catches of fishes in the warm-water arm of the lake were exceptionally good. In 1971, the catch from this 117 acre arm was 689.7 fish per acre. Wind, shallow water, and turbidity characterized Thomas Hill Reservoir. Wave action kept clay particles in suspension and greatly influenced shoreline development. Thomas Hill is the only large Missouri Reservoir that remains frozen through the cold season and should typify other north Missouri reservoirs scheduled for construction. (Auth.)

19062. Desaiah, D., and R. B. Koch (Dept. of Biochem., Mississippi State Univ., Mississippi State, Miss. 39762). 1975. TOXAPHENE INHIBITION OF ATPase ACTIVITY IN CATFISH, Ictalurus punctatus, TISSUES. Bull. Environ. Contamin. Toxicol., 13(2): 238-244.

19063. Overstreet, Robin M. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1974. AN ESTUARINE LOW-TEMPERATURE FISH-KILL IN MISSISSIPPI, WITH REMARKS ON RESTRICTED NECROPSIES. Gulf Research Reports, 4(3): 328-350.

In January 1973, large numbers of Mugil cephalus (striped mullet), weighing approximately 250 gm each, died in two freshwater localities in tidewater bayous of Jackson County, Mississippi. Fish identified as Mugil curema, M. cephalus, Megalops atlantica, Dormitator maculatus, and Fundulus grandis were found dead in other low saline estuarine areas. Fish-kills during cold periods are less commonly encountered in Mississippi than in Texas or Florida. This particular incident is attributed to conditions of stress for fishes incompletely acclimated to the encountered low temperatures. The deleterious stress was the low saline water which probably allowed a breakdown in the fishes' ion-osmoregulatory mechanisms. Striped mullet and other erryhaline fishes in salinities greater than 6 ppt survived, as did freshwater centrarchids and ictalurids in areas with dying mullet. Other stresses thought to contribute to the weakening of striped mullet in Paige Bayou during the period of rapidly decreasing temperatures include starvation and high levels of pesticide residues. In examined fish, the alimentary tracts were devoid of food, the gall bladders were distended and leaking bile, the livers contained excess lipid material and were often stained throughout with bile pigments, and the levels of DDT metabolites and endrin residues in the liver were higher than in control fish. Stress caused by low levels of dissolved oxygen, toxic substances in the water, or disease was discounted as a cause of death. (Auth.)

19064. Ash, G. R., N. R. Chymko, and D. N. Gallup (Dept. of Zool., Univ. of Alberta, Edmonton, Alberta T6G 2E1, Canada). 1974. FISH KILL DUE TO "COLD SHOCK" IN LAKE WABAMUN, ALBERTA. J. Fish. Res. Board Can., 31(11): 1822-1824.

A thermal fish kill due to "cold shock" caused by a mechanical failure in the steam electric generating unit was observed in Lake Wabamun, Alberta on February 8, 1973 in the region of the discharge canal. The most rapid temperature decline occurred in the initial 30 min after shutdown when the temperature dropped 16.9 C (21.8 to 4.9 C). The major fish species affected included spottail shiners (Notropis hudsonius) and northern pike (Esox lucius). The freshwater clam Anodonta sp. did not appear to be affected. (Authors)

19065. Mearns, Alan J., and Marjorie Sherwood (S. California Coastal Water Research Project, El Segundo, California 90245). 1974. ENVIRONMENTAL ASPECTS OF FIN EROSION AND TUMORS IN SOUTHERN CALIFORNIA DOVER SOLE. Trans. Amer. Fish. Soc., 103(4): 799-810.

19066. Krzywosz, Tadeusz (Inst. Rybactwa Srodladowego w Olsztynie, Zaklad Gospodarki Jeziorowej, Poland). 1973. GROWTH OF GRASS CARP - Ctenopharyngodon idella (Valenciennes 1844) IN THE LAKE DGAL WIELKI. (Wzrost amura bialego - Ctenopharyngodon idella (Valenciennes 1844) w Jeziorze Dgal Wielki). Roczniki Nauk Rolniczych, 95(3): 91-100.

Growth of grass carp introduced into the lake Dgal Wielki (Olsztyn province) was determined. The growth rate of grass carp in the investigated lake was found to exceed the quickest growing population in the Amur river-basin. (Synopsis)

19067. Machniak, Kazimierz, and John H. Gee (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada). 1975. ADJUSTMENT OF BUOYANCY BY TADPOLE MADTOM, Noturus gyrinus, AND BLACK BULLHEAD, Ictalurus melas, IN RESPONSE TO A CHANGE IN WATER VELOCITY. J. Fish. Res. Board Can., 32(2): 303-307.

Tadpole madtom (Noturus gyrinus) and black bullhead (Ictalurus melas) adjusted buoyancy by altering swimbladder volume becoming less buoyant in current than in still. Extent of adjustment was dependent on size. Tadpole madtom adjusted buoyancy within 96-192 h but partial adjustment occurred within 12-48 h. Year 0 fish made a more rapid decrease in buoyancy than did year 1 or 2. As buoyancy was decreased year 0 and 1 tadpole madtom showed significant changes in internal pressure of swimbladder gases. Black bullhead secreted gases into the swimbladder to increase buoyancy while tadpole madtom showed no such ability. (Authors)

19068. Poston, Hugh A. (U.S. Fish and Wildlife Serv., Tunison Lab. of Fish Nutrition, Cortland, New York 13045). 1974. EFFECT OF FEEDING BROWN TROUT (Salmo trutta) A DIET PELLETED IN DRY AND MOIST FORMS. J. Fish. Res. Board Can., 31(11): 1824-1826.

Growth rate, body composition, and intake of either dry matter or energy did not differ significantly ($P > 0.05$) between two groups of juvenile brown trout (Salmo trutta) fed either a low- or high-moisture semipurified diet at different rates to compensate for a diet energy density gradient. Feed/gain efficiency, on an as-fed basis, was significantly greater ($P < 0.01$) in fish fed the low-moisture diet, but did not differ ($P > 0.05$) when compared on the basis of dry matter or energy intake. (Auth.)

19069. Schwartz, Frank J. (Inst. of Marine Sciences, Univ. of North Carolina, Morehead City, N. C. 28557). 1975. A CREVALLE JACK, Caranx hippos (PISCES, CARANGIDAE), WITH A MANDIBULAR CALCIFIED CONNECTIVE TISSUE FIBROMA. Chesapeake Science, 16(1): 72-73.

An 84 cm adult crevalle jack, Caranx hippos, was caught on hook and line off Murrill's Inlet, South Carolina, with enlarged bulbous mandibles. Staining and sectioning revealed bony tissue throughout these bulges and ruled out parasitic copepods as possible causal agents of the bulges. The fish was normal in all respects. The tumor was unencapsulated and non-invasive. Radiographs revealed no metastases. (Auth.)

19070. Burkett, Robert D. (Dept. of Zool., The Ohio State Univ., Columbus, Ohio 43210). 1974. THE INFLUENCE OF TEMPERATURE ON UPTAKE OF METHYLMERCURY-203 BY BLUNTNOSE MINNOWS, Pimephales notatus (Rafinesque). Bull. Environ. Contamin. Toxicol., 12(6): 703-709.

19071. Snow, J. R. (Marion National Fish Hatchery, Marion, Alabama 36756). 1974. CHANGES IN POND BOTTOM SOILS DURING THE FIRST TEN YEARS OF USE. Proc. 27th Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 14-17, 1973, pp. 738-745.

A study to determine changes in pond bottom soil composition has been in progress on the Marion, Alabama National Fish Hatchery for more than ten years. This report gives the findings of analyses for calcium, phosphorus, potassium, pH, nitrogen and organic carbon. Samples were taken periodically from the same locations with the last ones taken ten years after the initial flooding. During the period, pH changed from acid to neutral levels generally. Phosphorus increased in some ponds and decreased in others. One pond which was unfertilized supported a luxuriant growth of Najas sp. and Chara sp. even though no available phosphorus was measured in the soil sample. Organic nitrogen and carbon increased appreciably with nitrogen increasing at a greater rate. The carbon/nitrogen (C/N) ratio became narrower in 11 of 12 ponds. (Auth.)

19072. Tackett, Dewey L, John J. Giudice, and R. W. Raible (U.S. Dept. of the Interior, Fish Farming Exp. Station, Stuttgart, Arkansas 72160). 1974. A RESPIROMETER WITH CONTROLLABLE OXYGEN LEVELS. Reprint: Trans. Amer. Fish. Soc., 103(4): 825-828.

Construction details and operation of a respirometer with capabilities for controlling the oxygen level at preselected levels is described. The interaction of an oxygen sensor and electronic switch energizes an electrolysis cell which replenishes oxygen used by a test organism. Respiration rate of any aquatic or semiaquatic organism may be determined by this apparatus. (Authors)

19073. Neill, William H., and John J. Magnuson (Lab. of Limnology, Dept. of Zoology, Univ. of Wisconsin, Madison, Wisconsin 53706). 1974. DISTRIBUTIONAL ECOLOGY AND BEHAVIORAL THERMOREGULATION OF FISHES IN RELATION TO HEATED EFFLUENT FROM A POWER PLANT AT LAKE MONONA, WISCONSIN. Trans. Amer. Fish. Soc., 103(4): 663-710.

19074. Riehl, Von R., and K. J. Götting (Zool. Inst., D-63 Giessen, Stephanstr. 24, West Germany). 1974. STRUCTURE AND OCCURRENCE OF THE MICROPYLE IN EGG CELLS AND EGGS OF TELEOST FISHES (Zu Struktur und Vorkommen der Mikropyle an Eizellen und Eiern von Knochenfischen (Teleostei)). Arch. Hydrobiol., 74(3): 393-402.

Since by Doyere a micropyle was described for the eggs of Syngnathus, this structure has been proved in about 70 species of teleosts, not always without any doubt. In this paper the list of species with micropyles is complemented numbering now 87 teleosts. There are three different types of structure of the micropyle to be distinguished: 1) a hollow pit leading into a short canal, 2) a flat pit and a longer canal, 3) micropyles only represented by a canal. Histological investigations on the formation of the micropyles will follow. (Authors)

19075. Broussard, Meryl C., Jr., Nick C. Parker and Bill A. Simco (Dept. of Biol., Memphis State Univ., Memphis, Tenn. 38152). 1974. CULTURE OF CHANNEL CATFISH IN A HIGH FLOW RECIRCULATING SYSTEM. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 745-750.

An indoor recirculating system was designed to evaluate the effects of a high flow rate and a high filter to tank ratio on the carrying capacity of a closed system for channel catfish culture. Updraft and trickling filters with various filter media were evaluated. A net gain of 319 pounds, with a standing crop of 405 pounds at a density of 7.2 pounds per cubic foot, was obtained over a 142 day growing period. (Authors)

19076. Snieszko, S. F. (Eastern Fish Disease Lab., Leetown (P. O. Kearneysville), West Virginia 25430). 1974. NUTRITIONAL (DIETARY) GILL DISEASE AND OTHER LESS KNOWN GILL DISEASES OF FRESHWATER FISHES. U.S. Dept. of the Interior, Fish and Wildlife Service, FDL-36 (Revision of FDL-23), 2 p.

19077. Power, G., and Douglas Cressman (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario N2L 3G1). 1975. ATLANTIC SALMON (Salmo salar) TAKEN IN THE SEA IN NORTH LABRADOR. J. Fish. Res. Board Can., 32(2): 307-309.

Scale analysis showed that with few exceptions salmon taken near the northern extremity of Labrador were similar to stocks from Ungava rivers; those taken near Nain were probably of local origin. Knowledge of the distribution of local stocks of salmon in the sea contributes to our understanding of their migrations and is valuable in view of the recent development of commercial fisheries for this species in the northwest Atlantic. (Authors)

19078. Gerard, M. J.-P. (Lab. d'Ichtyopathologie de l'INRA 78850, Thiverval-Grignon, France). 1974. ON DISINFECTION IN PISCICULTURE. (Sur la Desinfection en Pisciculture). Bull. Francais de Pisciculture, 254(3):20-22, Technical Note No. 0.6, in French.

19079. Novik, L. I. (Minvodkhoz, Belorussian SSR). 1973. FISH WEED CANALS. Gidrotekhnika i Melioratsiya, 25(6): 12-13; Weed Abstracts, 23(10): abstract No. 2243, 1974.

In 1972, 2000 two-year-old carp (Ctenopharyngodon idella) weighing 250-300 g each were stocked in a 0.5- to 2-m depth of water in a 10-ha area of the Tsakhminskii Canal. In Spring and summer, the fish eliminated all underwater vegetation in the 12-km length of canal and attained an average wt. of 550-700 g by September. Young fish avidly consumed submersed and floating vegetation and 3-year-old fish tackled reed (Phragmites communis), club-rush (Scirpus sp., sedges (Carex spp.) and horsetail (Equisetum sp.); the fish consumed 30-35 kg of soft vegetation or 60 kg of fibrous vegetation for every kg gain in wt. Effective stocking rates for canals overgrown by 10- > 80% ranged from 150 to 1000/ha for 1-year-old fish and from 50 to 400/ha for 2- to 3-year old fish. When the water temp. drops below 8-6 C at the end of summer, the fish are overwintered in special reservoirs monitored daily for O_2, CO_2 and Fe contents and pH. In 1973, the Berezinskii, Vileiskii, Pripyatskii and Oresskii authorities were each allocated 3000 two-year-old fish for weeding canals.

19080. Vrijenhoek, R. C. (Dept. of Biol., Southern Methodist Univ., Dallas, Texas 75275). 1975. EFFECTS OF PARASITISM ON THE ESTERASE ISOZYME PATTERNS OF FISH EYES. Comp. Biochem. Physiol., 50(1B): 75-76.

Wild caught fishes of the family Poeciliidae were examined for infection by metacercariae of the trematode parasite Neascus sp. Eye tissues of all individuals of Peociliopsis lucida were heavily infected whereas no Poeciliopsis latidens were infected, although they coexist in the same stream. Some individuals of Poecilia butleri had low-grade eye infections. Electrophoretic patterns of nonspecific esterases from eye tissues revealed many additional isozymes in infected fishes. Histochemical examinations revealed that the additional isozymes were contributed by the parasite. Examination for parasites in the tissues of wild fishes is recommended prior to their use in electrophoretic studies of genetic variation. (Auth.)

19081. Mundie, J. H. (Dept. of the Environ., Fish. and Mar. Service, Pacific Biol. Sta., Nanaimo, British Columbia V9R 5K6, Canada). 1974. OPTIMIZATION OF THE SALMONID NURSERY STREAM. J. Fish. Res. Board Can., 31(11): 1827-1837.

The minimum unit of the environment containing the essential processes of smolt production is identified as a riffle-pool sequence at a meander. Optimization for smolt rearing is seen to lie through control of discharge, temperature, food production, and cover. The pathways of food production are traced. Ways of increasing the stock of fish-food organisms include adjustment of the ratio of riffle to pool area, choice of streamside vegetation, control of light to the stream, and inorganic and organic enrichment. Ways of making food available to fry include collecting drifting invertebrates at night and releasing them in the day, dislodgement of benthos, attracting aerial insects by lights, and supplementary feeding with artificial foods. None of these procedures, when applied to a natural stream, seems economically feasible. When applied, however, to channels made alongside streams and stocked by the parent stream, they should combine some desirable features of rivers with the productive capacity, but not the costs, of hatcheries. (Auth.)

19082. Rohde, Fred C., Rudolf G. Arndt, and Johnson C. S. Wang (Inst. of Mar. Sciences, Univ. of North Carolina, Morehead City, N. C. 28557). 1975. RECORDS OF THE FRESHWATER LAMPREYS, Lampetra lamottenii AND Okkelbergia aepyptera, FROM THE DELMARVA PENINSULA (EAST COAST, UNITED STATES). Chesapeake Science, 16(1):70-72.

19083. Bailey, William M., Fred P. Meyer, J. Mayo Martin, and D. Leroy Gray (Arkansas Game and Fish Comm., Little Rock, Arkansas). 1974. FARM FISH PRODUCTION IN ARKANSAS DURING 1972. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 750-758.

Fish farming in Arkansas continues to be a major industry with 1972 returns exceeding $21 million. This indicates an overall increase in value of 23.5 percent since 1969. Acreage of intensively-farmed waters increased 15.7 percent since 1969. Data collected during this survey indicates that a peak in the industry was reached between 1969 and 1972 and that during the past year acreages devoted to fish production declined slightly. Personal interviews of fish farmers provided the most useful data in determining the total production. Acreage, production and dollar values are presented in categories of food fish, bait fish, fingerlings, and fee fishing. Specialized fish-rearing facilities and the production of uncommon types of fishes are discussed. (Authors)

19084. Armstrong, James G. (U. S. Fish and Wildl. Serv., 601 East 12th Street, Kansas City, Missouri 64106). 1973. SQUAMATION CHRONOLOGY OF THE ZEBRAFISH (CYPRINIDAE), Brachydanio rerio. Copeia, No. 4, pp. 823-824.

Time and order of scale appearance is documented for the zebrafish through the use of a narrative and a series of line drawings. Squamation of the zebrafish is compared with that of other fishes. Scale development begins only when a mean length of 1.15 cm (± 0.03) is reached, and is correlated to length rather than age. (Auth.)

19085. Kellogg, Thomas F. (Dept. of Biochem., Agric. and Forestry Exper. Sta., Mississippi State Univ., Mississippi State, Miss. 39762). 1975. THE BILIARY BILE ACIDS OF THE CHANNEL CATFISH, Ictalurus punctatus, AND THE BLUE CATFISH, Ictalurus furcatus. Comp. Biochem. Physiol., 50(1B): 109-111.

The biliary bile acids of the channel catfish, Ictalurus punctatus, and the blue catfish, Ictalurus furcatus, have been determined. In both species the biliary bile acids are composed of taurocholic acid: 83% - I. punctatus, 84% - I. furcatus; taurochenodesoxycholic acid: 15% - I. punctatus, 16% - I. furcatus, taurodesoxycholic acid: 2% - I. punctatus only. These bile acids are consistent with the phylogenetic placement of these species in suborder silurodei. (Auth.)

19086. Collins, John J. (Fish and Wildl. Res. Branch, Ontario Min. of Nat. Resources, South Bay Fish. Res. Sta., Tahkummah, Ontario P0P 2C0, Canada). 1975. OCCURRENCE OF PINK SALMON (Oncorhynchus gorbuscha) IN LAKE HURON. J. Fish. Res. Board Can., 32(3): 402-404.

Pink salmon (Oncorhynchus gorbuscha), which were introduced into Lake Superior in 1956 and have produced eight natural generations there, have not appeared in Lake Huron. The first pink salmon was taken in Ontario waters of Lake Huron in 1971. Successful spawning was observed in one tributary in 1973, indicating that pink salmon could become established in Lake Huron. (Auth.)

19087. Mehrle, Paul M., and Mary E. DeClue (Fish-Pesticide Res. Lab., U. S. Fish and Wildl. Service, Columbia, Missouri 65201). 1973. PHENYLALANINE DETERMINATION IN FISH SERUM: ADAPTATION OF A MAMMALIAN METHOD TO FISH. Reprint: Analytical Biochemistry, 52(2): 660-661.

19088. Anderson, C. D., and R. J. Roberts (Unit of Aquatic Pathobiol., Univ. of Stirling, Stirling, Scotland). 1975. A COMPARISON OF THE EFFECTS OF TEMPERATURE ON WOUND HEALING IN A TROPICAL AND A TEMPERATE TELEOST. J. Fish Biol., 7(2): 173-182.

The rate of healing of a surgical wound was studied in two teleost fish, one with a tropical, and the other with a temperate temperature range. Comparisons were made of both the rate and qualitative nature of wound healing within and between species at temperatures of 30, 23, 10 and 5°C. The rate of wound healing was found to be proportional to temperature and temperature stress had little effect on healing rates. The findings were related to reported rates of wound healing in man. In general, the wounds studied healed at a rate comparable to those reported for the healing of superficial skin wounds in man and other mammals despite the fact that the fish wounds were not merely superficial but involved integument and muscle. (Authors)

19089. Gruger, Edward H., Jr., Neva L. Karrick, Arnold I. Davidson, and Thomas Hruby (Northwest Fish. Center, NMFS, NOAA, U. S. Dept. of Commerce, Seattle, Washington 98112). 1975. ACCUMULATION OF 3, 4, 3', 4'-TETRACHLOROBIPHENYL AND 2, 4, 5, 2', 4', 5'- AND 2, 4, 6, 2', 4', 6'-HEXACHLOROBIPHENYL IN JUVENILE COHO SALMON. Environ. Sci. Technol., 9(2): 121-127.

19090. Muscarella, A., and V. Galofaro (Pat. Vet., Univ. Messina, Italy). 1973. PATHOLOGICAL LESIONS IN SOME FRESH-WATER FISH CAUSED BY PARAQUAT. Nuova Veterinaria, 49(4): 211-221; from Veterinary Bull. No. 44, 3330; Weed Abstracts, 23(11): abstract 2703, 1974.

Paraquat at 250 ppm was added to the water of 10 tench, 10 goldfish and 10 loach. Some of the tench died within 12 h but the loach and goldfish survived 24 h of contact with paraquat. The most serious lesions were those on the skin and gills.

19091. Desaiah, D., and R. B. Koch (Dept. of Biochem., Mississippi State Univ., Mississippi State, Miss. 39762). 1975. INHIBITION OF ATPases ACTIVITY IN CHANNEL CATFISH BRAIN BY KEPONE® AND ITS REDUCTION PRODUCT. Bull. Environ. Contamin. Toxicol., 13(2): 153-158.

19092. Yamamoto, T. (Dept. of Microbiol., The Univ. of Alberta, Edmonton, Alberta, Canada). 1975. INFECTIOUS PANCREATIC NECROSIS VIRUS AND BACTERIAL KIDNEY DISEASE APPEARING CONCURRENTLY IN POPULATIONS OF Salmo gairdneri AND Salvelinus fontinalis. J. Fish. Res. Board Can., 32(1): 92-95.

An investigation into disease problems at a hatchery revealed the coexistence of bacterial kidney disease and infectious pancreatic necrosis (IPN) virus in various lots of rainbow (Salmo gairdneri) and eastern brook (Salvelinus fontinalis) trout. During the study, increased mortality rates occurred in yearling brook trout with concurrent infections of bacterial kidney disease and IPN, but the mortality appeared to be primarily associated with the bacterial agent. Evidence is presented to indicate that infection with virus preceded the bacterial infection. Electron microscopic examination of kidney tissues showed that both agents could be found within the same cells. (Auth.)

19093. Siefert, R. E., A. R. Carlson, and L. J. Herman (U.S. Environ. Protection Agency, Nat. Water Qual. Lab., Duluth, Minnesota 55804). 1974. EFFECTS OF REDUCED OXYGEN CONCENTRATIONS ON THE EARLY LIFE STAGES OF MOUNTAIN WHITEFISH, SMALLMOUTH BASS, AND WHITE BASS. Prog. Fish-Cult., 36(4): 186-191, illus.

19094. Ingham, Brian, and Michael A. Gallo (May & Baker, Ltd., Dagenham, Essex, England). 1975. EFFECT OF ASULAM IN WILDLIFE SPECIES. ACUTE TOXICITY TO BIRDS AND FISH. Bull. Environ. Contamin. Toxicol., 13(2): 194-199.

19095. Duthu, Gwen S., and Ronald H. Kilgen (Dept. of Biol. Sci., Nicholls State Univ., Thibodaux, Louisiana 70301). 1975. AQUARIUM STUDIES ON THE SELECTIVITY OF 16 AQUATIC PLANTS AS FOOD BY FINGERLING HYBRIDS OF THE CROSS BETWEEN Ctenopharyngodon idella ♂ AND Cyprinus carpio ♀. J. Fish Biol., 7(2): 203-208.

Fish hybrids of the cross Ctenopharyngodon idella ♂ (grass carp) and Cyprinus carpio ♀ (Israeli carp), averaging 124 mm total length and 20 g in weight were stocked in aquaria along with 16 different aquatic plants to determine which plants they would eat. Observations showed that one group of plants was highly utilized (Azolla caroliniana, Lemna spp., Cladophora sp., Spirogyra sp., Nymphaea odorata); another group was moderately utilized (Pistia stratiotes, Ruppia maritima, Najas flexilis, Limnobium spongia, Potamogeton pectinatus). Two other groups were only poorly utilized (Ceratophyllum demersum, Eichhornia crassipes, Elodea sp.), or not utilized (Cabomba caroliniana, Sagittaria sp., Myriophyllum pinnatum). (Authors)

19096. Schneider, James A. (Section of Fisheries, Minnesota Dept. of Natural Resources, Finland, Minnesota 55603). 1974. DISPERSION OF A FINTROL CONCENTRATE-DYE MIXTURE APPLIED TO THE SURFACE OF A DIMICTIC LAKE AT FALL OVERTURN. Prog. Fish-Cult., 36(4): 192-195.

19097. Hinton, D. E. (Dept. of Anatomy, Health Sciences Center, Univ. of Louisville, School of Med., Louisville, Kentucky 40201). 1975. PERFUSION FIXATION OF WHOLE FISH FOR ELECTRON MICROSCOPY. J. Fish. Res. Board Can., 32(3): 416-422.

A method for obtaining uniform fixation of whole bodies of fish for electron microscopic study is described. The procedure employs vascular perfusion of aldehyde fixatives through the proximal aorta of anesthetized fish. Light microscopic examination of semi-thin (0.5-1 μ) sections of Epon embedded material, stained with toluidine blue, showed near to complete removal of blood cells from vessels of gill, bone, skin, skeletal muscle, heart, exocrine pancreas, mesentery, glomerulus, and brain. Electron microscopic examination of liver and kidney, fixed by whole body perfusion, showed excellent preservation of cell ultrastructure. (Auth.)

19098. Francis, A. A., Frances Smith, and Peter Pfuderer (Biol. Div., Oak Ridge National Lab., Oak Ridge, Tennessee 37830). 1974. A HEART-RATE BIOASSAY FOR CROWDING FACTORS IN GOLDFISH. Prog. Fish-Cult., 196-200.

19099. Chan, Hooi Har, and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1975. IDENTIFICATION OF IODOAMINO ACIDS IN THE PLASMA AND BILE OF BROOK TROUT, Salvelinus fontinalis (Mitchell). Can. J. Zool., 53(1): 97-101.

Thyroxine was the main labelled iodo-compound consistently detected by thin-layer chromatography in plasma and bile of starved TSH (thyroid-stimulating hormone)-treated brook trout previously injected with radioiodide. Failure to detect 3, 5, 3'-triiodo-L-thyronine and iodotyrosines contrasts with results of the few previous studies on circulating iodocompounds in teleosts. No labelled iodo-amino acids were detected in plasma of trout held under a variety of conditions but not treated with TSH. (Authors)

19100. Johnson, James E., and Bruce L. Swanson (Dept. of Forestry and Wildl. Management, Univ. of Massachusetts, Amherst, Mass. 01002). 1974. LENGTH AND WEIGHT CHANGES OF PRESERVED BLACK CRAPPIE AND YELLOW PERCH. Prog. Fish-Cult., 36(4): 201-206.

19101. Sameoto, D. D., D. C. Darrow, and S. Guildford (Dept. of the Environ., Fisheries and Marine Serv., Marine Ecol. Lab., Bedford Inst. of Oceanogr., Dartmouth, Nova Scotia B2Y 4A2, Canada). 1975. DDT RESIDUES IN EUPHAUSIIDS IN THE UPPER ESTUARY OF THE GULF OF ST. LAWRENCE. J. Fish. Res. Board Can., 32(2): 310-314.

No significant variation was found in organochlorine residue levels between different stations in an area from the Saguenay River to the end of the Gaspe Peninsula in the Gulf of St. Lawrence for the euphausiids Thysanoessa raschii, T. inermis, and Meganyctiphanes norvegica. Significant differences were found between the concentration of organochlorine residues for M. norvegica and the Thysanoessa species, but there was no difference between the two Thysanoessa species. Significantly lower values for percent lipid were found in T. inermis and T. raschii between June 1973 and May 1974 samples, but the total amount of organochlorine residues did not change. This suggests that these species do not lose p, p'-DDT when they metabolize lipids for energy or the production of gonad material. (Authors)

19102. Rickett, John D. (Museum of Natural History, Univ. of Kansas, Lawrence, Kansas 66044). 1974. TROPHIC RELATIONSHIPS INVOLVING CRAYFISH OF THE GENUS Orconectes IN EXPERIMENTAL PONDS. Prog. Fish-Cult., 36(4): 207-211.

19103. Bootsma, R., P. de Kinkelin, and Monique LeBerre (Dept. of Spec. An. Pathol., Faculty of Vet. Med., Biltstr. 172, Utrecht, The Netherlands). 1975. TRANSMISSION EXPERIMENTS WITH PIKE FRY (Esox lucius L.) RHABDOVIRUS. J. Fish Biol., 7(2): 269-276.

Experimental infection of fertilized pike eggs with 'red-disease' virus produced 100% mortality in the fry. This mortality was associated with a disease that had previously been described as hydrocephalus internus, indicating that 'red-disease' and hydrocephalus are different manifestations of the same disease. The name pike fry rhabdovirus disease (PFRD) is suggested for the disease complex, and the name pike fry rhabdovirus (PFR) for the causative agent. Exposure of PFR to a Wescodyne* solution containing 25 ppm of iodine resulted in an inactivation of at least 99.99% of viral activity within 30 sec. Experimental egg transmission of PFR could be interrupted by disinfecting the eggs in a Wescodyne solution, suggesting that the virus was located on the egg surface. Conclusive evidence of a naturally occurring vertical transmission in pike culture is still lacking because, using FHM cells as a detection system, PFR could not be found in spawners and their sexual products. The susceptibility of pike fry to PFR rapidly decreases at increasing age. (Authors)

19104. Soivio, Antti, Marjatta Malkonen, and Osmo Tuurala. 1974. EFFECTS OF ASPHYXIA AND MS-222 ANAESTHESIA ON THE CIRCULATION OF THE KIDNEY IN Salmo gairdneri Richardson. A MICROSCOPICAL STUDY. Annales Zoologici Fennici, 11(4): 271-275.

19105. Johnson, Jeffrey N., and Austin K. Andrews (Oklahoma Coop. Fish. Unit, Oklahoma State Univ., Stillwater, Okla. 74074). 1974. GROWTH OF WHITE CRAPPIE AND CHANNEL CATFISH IN RELATION TO VARIATIONS IN MEAN ANNUAL WATER LEVEL OF LAKE CARL BLACKWELL, OKLAHOMA. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 767-776.

Variations in annual increments of growth of white crappie, Pomoxis annularis Rafinesque, and channel catfish, Ictalurus punctatus (Rafinesque), are examined in relation to mean annual water level of Lake Carl Blackwell, 1962-1967, when lake level was declining. The occurrence of lee's phenomenon precluded a correlative comparison of white crappie growth with water level, but decrease in growth at age 1 and the increase at older ages is attributed to the decline in water level. The crappie body-scale relationship changed from curvilinear to linear as growth improved during the drawdown period. Correlations of channel catfish growth with lake level were significant for age 1 ($r = -0.84$, $P<0.05$), age 2 ($r = -0.92$, $P<0.01$) and age 6 ($r = -0.81$, $P<0.05$). We hypothesized that the declining water level increased the growth of channel catfish through reduced intraspecific and interspecific competition. The reduction in competition is believed to result from decreased spawning success and increased predation upon small channel catfish by piscivorous fishes such as largemouth bass and flathead catfish. (Authors)

19106. Anderson, William K., and William M. Lewis (Fisheries Res. Lab., and Dept. of Zool., Southern Illinois Univ., Carbondale, Illinois 62901). 1974. USE OF SUDDEN TEMPERATURE DECREASE TO REDUCE THE EXCITABILITY OF CHANNEL CATFISH DURING HANDLING. Prog. Fish-Cult., 36(4): 213-215.

19107. Schimmel, Steven C., and David J. Hansen (U.S. Environ. Protection Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, Florida 32561). 1975. AN AUTOMATIC BRINE SHRIMP FEEDER FOR AQUATIC BIOASSAYS. J. Fish. Res. Board Can., 32(2): 314-316.

An electrically operated brine shrimp feeder is described. The device may be set to cycle 1-12 times each day for tests in fish and invertebrate culture and bioassay. Major advantages of the feeder are that it is readily adapted to flow-through bioassay and culture apparatuses which require that equal quantities of food be delivered to animals in two or more test aquaria and that the number of feedings be recorded. The components, all readily available, cost approximately $190. (Authors)

19108. Dick, Gillian L. (White Fish Auth., Marine Cult. Unit, Hunterston, West Kilbride, Scotland). 1975. SOME OBSERVATIONS ON THE USE OF MS 222 SANDOZ WITH GREY MULLET (Mugil chelo Cuvier). J. Fish Biol., 7(2): 263-268.

19109. Terlecki, Janusz (Wyzsza Szkola Rolnicza w Olsztynie, Instytut Hydrobiologii i Ochrony Wod, Poland). 1973. FECUNDITY OF PIKE - Esox lucius Linnaeus 1758 FROM LAKE SNIARDWY. (Plodnosc Szczupaka - Esox lucius (Linneaus 1758) z Jeziora Sniardwy). Roczniki Nauk Rolniczych, 95(3): 161-176.

Ninety-six gonads of the female pikes (Esox lucius L.) coming from Sniardwy Lake were taken in the years 1968-1970 and their absolute fecundity has been determined. Dependence between absolute fecundity, body sizes and age of the fish was traced back. These dependences have been put in an equation of multiple regression their significance defined as t-test. Fecundity of the pike from Sniardwy Lake with that of pikes coming from other water reservoirs was compared.

19110. Maddock, Brian G. (Imperial Chemical Industries, Ltd., Brixham Lab., Brixham, Devon, England). 1974. A TECHNIQUE TO PROLONG THE INCUBATION PERIOD OF BROWN TROUT OVA. Prog. Fish-Cult., 36(4): 219-222.

19111. Sanborn, James R., William F. Childers, and Robert L. Metcalf (Illinois Nat. History Survey, Agric. Exp. Sta., and the Univ. of Illinois, Urbana, Illinois 61801). 1975. UPTAKE OF THREE POLYCHLORINATED BIPHENYLS, DDT, AND DDE BY THE GREEN SUNFISH, Lepomis cyanellus Raf. Bull. Environ. Contamin. Toxicol., 13(2): 209-217.

19112. Schoettger, R. A. (U.S. Fish & Wildl. Serv., Fish Pesticide Res. Lab., Route 1, Columbia, Missouri 65201). 1973. ACUTE TOXICITY OF PESTICIDES TO FRESHWATER FISH. U.S. Dept. of the Interior, Progress in Sport Fishery Research 1971, pp. 2-3; Weed Abstracts, 23(12): abstract 2889, 1974.

Static tests were carried out. The 96-h LC_{50} observed on the most sensitive species tested was 100-1000 µg/litre for Dacamine 4D [2, 4-D amine] and Outfox (cyprazine) and 10, 000 µg/litre for Daconate [MSMA] and Ded-Weed [dalapon].

19113. Snow, J. R., and R. T. Lovell (U.S. Fish & Wildl. Serv., Warm-Water Development Center, Marion Nat. Fish Hatchery, Marion, Alabama 36756). 1974. COMPARISON OF ORGANOLEPTIC QUALITY OF LARGEMOUTH BASS FED NATURAL AND ARTIFICIAL DIETS. Prog. Fish-Cult., 36(4): 216-218.

19114. Eisler, R., G. E. Zaroogian, and R. J. Hennekey (U.S. Environ. Protection Agency, Nat. Marine Water Qual. Lab., West Kingston, Rhode Island 92892). 1972. CADMIUM UPTAKE BY MARINE ORGANISMS. J. Fish. Res. Board Can., 29(9): 1367-1369.

Adults of mummichog, Fundulus heteroclitus, scallop Aquipecten irradians, oyster Crassostrea virginica, and subadult lobsters Homarus americanus were immersed for 21 days in flowing sea water containing 10 µg/liter of cadmium as $CdCl_2 \cdot 2\text{-}1/2H_2O$. Cadmium residues in whole animals and selected tissues were consistently higher in exposed organisms than controls; edible portions of treated lobster (muscle), scallop (adductor muscle), and oyster (whole animal) contained more cadmium per unit wet weight than controls by 25%, 19%, and 352%, respectively. (Authors)

19115. Gerard, M. J.-P., and L. Tiret (Inst. National de la Recherche Agronomique, Lab. d'Ichtyopatholigie, 78850 Thiverval-Grignon, France). 1974. A WATER FILTRATION PLANT FOR USE IN REARING FISH FRY (Dispositif de filtration des eaux pour les Laboratoires d'alevinage en Pisciculture). Bull. Francais de Pisciculture, 254(3):23-33, Technical Note No. 0.7, in French, illus.

19116. Hawkes, Clifford L. (USDA Forest Serv., Pacific Northwest Forest and Range Exp. Sta., Forestry Sciences Lab., Corvallis, Oregon 97331). 1975. ESTIMATING DRY WEIGHT OF LIVE, UNANESTHETIZED FISH BY PHOTOGRAPHY. J. Fish. Res. Board Can., 32(2): 321-324.

A photographic technique for indirectly estimating the dry weight of live fish is described with an example for fingerling coho salmon (Oncorhynchus kisutch). This technique does not utilize anesthetizing, blotting, or other harsh treatments associated with weighing live fish. It was developed for studies on which size, weight, etc., must frequently be obtained with a minimum of damage to the fish. The example given is the development of the regression equation correlating actual dry weights with photographically measured indices of lateral area. The equation obtained has a coefficient of determination (r^2) of 0.954. (Auth.)

19117. O'Gorman, Robert (U.S. Fish & Wildl. Serv., Great Lakes Fish. Lab., Ann Arbor, Michigan 48107). 1974. PREDATION BY RAINBOW SMELT (Osmerus mordax) ON YOUNG-OF-THE-YEAR ALEWIVES (Alosa pseudoharengus) IN THE GREAT LAKES. Prog. Fish-Cult., 36(4): 223-224.

19118. Kunesh, William H., Walter J. Freshman, Maynard Hoehm, and Norman G. Nordin (U.S. Fish & Wildl. Serv., National Fish Hatchery, Saratoga, Wyoming 82331). 1974. ALTERING THE SPAWNING CYCLE OF RAINBOW TROUT BY CONTROL OF ARTIFICIAL LIGHT. Prog. Fish-Cult., 36(4): 225-226.

19119. Kynard, Boyd, and Edward Lonsdale (Arizona Coop. Fishery Unit, Univ. of Arizona, Tucson, Arizona 85721). 1975. EXPERIMENTAL STUDY OF GALVANONARCOSIS FOR RAINBOW TROUT (Salmo gairdneri) IMMOBILIZATION. J. Fish. Res. Board Can., 32(2): 300-302.

Galvanonarcosis treatments had no significant effect on growth or photonegative behavior of rainbow trout (Salmo gairdneri). The data indicate the potential usefulness of the technique for immobilizing fish. (Authors)

19120. Newburg, Huon J. (Minn. Dept. of Natural Resources, Div. of Fish and Wildlife, St. Paul, Minnesota 55155). 1974. PLANARIANS AS A MORTALITY FACTOR ON SPAWNED FISH EGGS. Prog. Fish-Cult., 36(4): 227-230.

19121. Harders, Fred R., and William D. Davies (Dept. of Fish. and Allied Aquacultures, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1974. VARIATION IN GROWTH OF BLUEGILL ATTRIBUTED TO DIFFERENTIAL STOCKING RATES OF ADULT FISH IN LARGEMOUTH BASS-BLUEGILL COMBINATIONS. Proc. 27th Ann. Conf. Southeastern Assoc. Game and Fish Commissioners, Oct. 14-17, 1973, pp. 777-782.

The growth of bluegill is compared from four Alabama farm ponds where two ponds were stocked with adult bass and bluegill and two were stocked with adult bass and fingerling bluegill. Results from fishing records show that the stocking rate of adult bass plus fingerling bluegill produces larger than average bluegill the first year after stocking. (Authors)

19122. Gale, William F., and J. Douglas Thompson (Ichthyological Associates, Inc., Berwick, Pennsylvania 18603). 1974. PLACEMENT AND RETRIEVAL OF ARTIFICIAL SUBSTRATE SAMPLERS BY SCUBA. Prog. Fish-Cult., 36(4): 231-233.

19123. Schoettger, R. A. (U.S. Fish & Wildlife Service, Fish Pesticide Res. Lab., Route 1, Columbia, Missouri 65201). 1973. BIOLOGICAL MAGNIFICATION AND RETENTION OF RADIOLABELED COMPOUNDS IN INVERTEBRATES. U. S. Dept. of the Interior, Progress in Sport Fishery Research 1971, pp. 3-4; Weed Abstracts, 23(12): abstract 2890, 1974.

Higher order consumers are exposed to appreciable amounts of contaminants via their food and water; ^{14}C-2,4-D dimethylamine was magnified 40-350 times above water concns in scud (Gammarus lacustris) and waterfleas (Daphnia magna). Waterfleas exposed continuously to 40 μg 2,4-D/litre reached equilibrium at 24 h when the total body residue was 1 mg/kg. Within 4 h of exposure to herbicide-free water, 36% of the total body residue was lost and no residue was left after 5 days.

19124. Hettler, William F., Jr. (Nat. Mar. Fish. Serv., Atlantic Estuarine Fish. Center, Beaufort, North Carolina 28516). 1974. A FILTER AND CHILLER FOR AN OPEN SEAWATER SYSTEM. Prog. Fish-Cult., 36(4): 234-238, illus.

19125. Glenn, C. L. (Dept. of Zool., Brandon Univ., Brandon, Manitoba R7A 6A9, Canada). 1975. ANNUAL GROWTH RATES OF MOONEYE, Hiodon tergisus, IN THE ASSINIBOINE RIVER. J. Fish. Res. Board Can., 32(3): 407-410.

Estimates of back calculated lengths at each age for 669 mooneye (Hiodon tergisus) from the Assiniboine River indicate that annual length increments decrease progressively with age. Weight increments, calculated from estimates of weights at corresponding lengths, were greatest for mooneye during their fourth year of life. Both sexes of young mooneye had similar growth rates but after age III females grew more rapidly than male fish. (Auth.)

19126. Voth, David R., Lowell F. Anderson, and Stephen J. Kleinschuster (Metropolitan State College, Denver, Colorado 80204). 1974. THE INFLUENCE OF WATERFLOW ON BROWN TROUT PARASITES. Prog. Fish-Cult., 36(4): p. 212.

19127. Healey, M. C., and C. W. Nicol (Dept. of the Environ., Fish. and Mar. Serv., Pacific Biol. Sta., Nanaimo, British Columbia V9R 5K6, Canada). 1975. FECUNDITY COMPARISONS FOR VARIOUS STOCKS OF LAKE WHITEFISH, Coregonus clupeaformis. J. Fish. Res. Board Can., 32(3): 404-407.

We found no significant differences in slope or intercept for the regression of $\log_e$ fecundity on $\log_e$ fork length among samples of whitefish from four lakes near Yellowknife in the Northwest Territories. The equation describing the relationship between fecundity and fork length for these populations was:

$$\text{Fecundity} = 0.0404 \text{ length}^{3.527}_{(\text{cm})}$$

Five other populations for which length-fecundity relationships could be calculated had length exponents ranging from 3.20 to 4.38, suggesting a nonlinear relationship between weight and fecundity. Six of the nine populations as well as four others for which limited data were available all had similar relative fecundities. Fish from Buck Lake in Alberta and from Lake Erie had high relative fecundities while fish from Great Slave Lake has low relative fecundity. (Authors)

19128. Phillips, E. S. (Dept. of Natural Resources, New York State Coll. of Agriculture and Life Sciences, Cornell Univ., Ithaca, New York 14850). 1974. A PORTABLE AND RELATIVELY INEXPENSIVE SCALE PROJECTOR. Prog. Fish-Cult., 36(4): 239-242, illus.

19129. Schoettger, R. A. (U. S. Fish & Wildlife Service, Fish Pesticide Res. Lab., Route 1, Columbia, Missouri 65201). 1973. UPTAKE AND EXCRETION OF 2,4-D DMA IN RAINBOW TROUT. U. S. Dept. of the Interior, Progress in Sport Fishery Research 1971, pp. 5-6; Weed Abstracts, 23(12): abstract 2891, 1974.

After exposure to ^{14}C-2,4-D dimethylamine, magnification of the herbicide in trout was only 1.2-5 times the concn. in water; no radioactivity was detected 8 days after the end of exposure suggesting that the herbicide may be relatively safe for intermittent use in fisheries.

19130. Ross, A. J., and Robert J. Toth (U.S. Fish and Wildl. Service, Western Fish Disease Lab., Bldg. 204, Naval Support Activity, Seattle, Washington 98115). 1974. Lactobacillus - A NEW FISH PATHOGEN? Prog. Fish-Cult., 36(4): 191.

19131. Rumsey, G. L., and H. G. Ketola (U.S. Fish & Wildl. Service, Tunison Lab. of Fish Nutrition, Cortland, New York 13045). 1975. AMINO ACID SUPPLEMENTATION OF CASEIN IN DIETS OF ATLANTIC SALMON (Salmo salar) FRY AND OF SOYBEAN MEAL FOR RAINBOW TROUT (Salmo gairdneri) FINGERLINGS. J. Fish. Res. Board Can., 32(3): 422-426.

Fry of Atlantic salmon (Salmo salar) fed a diet containing isolated fish protein grew significantly faster than those fed a diet containing casein without supplemental amino acids, and had improved feed conversion and lower mortality. Supplementing the casein diet with essential amino acids to the levels in the isolated fish protein diet significantly increased growth rate, reduced mortality, and improved feed conversion. When fingerling rainbow trout (S. gairdneri) were fed diets containing soybean meal as the sole source of protein, additions of amino acids to simulate those levels of essential amino acids in trout eggs and isolated fish protein significantly improved growth. Additions of methionine, lysine, histidine, and leucine individually and in several combinations had no effect. (Authors)

19132. McCraren, Joseph P., and Roy M. Jones (U.S. Fish and Wildl. Service, Warmwater Hatchery Biologist Center, National Fish Hatchery, Tishomingo, Okla. 73460). 1974. RESTORATION OF SOCK FILTERS USED TO PREVENT ENTRY OF WILDFISH INTO PONDS. Prog. Fish-Cult., 36(4): 222.

19133. McCleary, John D. (Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543). 1974. NEAR SURFACE SAMPLER. Prog. Fish-Cult., 36(4): 233.

19134. Healey, M. C. (Dept. of the Environ., Fish. and Mar. Service, Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1975. DYNAMICS OF EXPLOITED WHITEFISH POPULATIONS AND THEIR MANAGEMENT WITH SPECIAL REFERENCE TO THE NORTHWEST TERRITORIES. J. Fish. Res. Board Can., 32(3): 427-448.

Available data on mortality, growth, reproduction, and stock size in exploited and unexploited populations of lake whitefish (Coregonus clupeaformis) are reviewed with a view to understanding the dynamics of exploited populations and improving their management. Natural mortality ranged from about 0.20 to 0.80 in unexploited populations. In exploited populations total mortality was as high as 0.94. Unexploited populations showed a wide range of growth rates. Growth rate increased with increasing exploitation, and growth rate in all heavily exploited populations was similar to the most rapid growth rate shown by unexploited stocks. Heavily exploited whitefish matured at a younger age and possibly also at a smaller size than those which were unexploited. Limited data on stock size suggest that although total population size declines under heavy exploitation, the vulnerable population remains of similar size. It is concluded that whitefish respond to fluctuations in population size through compensatory changes in growth rate. The difference between growth rate in a population and maximum growth rate is a measure of its scope for compensating for increased mortality. Populations with slow growth rate and low mortality should, therefore, have the best fishery potential, while those with high growth rate and high mortality have a low fishery potential. Further, it is possible to judge the fishery potential of a population or its stage of exploitation from relatively simple measurements of mortality, growth, age structure, and maturity. (Auth.)

19135. Smith, Fred G. (Coll. of Veterinary Med. and the Coop. Fisheries Unit, Univ. of Georgia, Athens, Georgia 30602). 1974. TRANSPARENT TAPE USED TO HOLD FISH SCALES FOR MICROSCOPIC EXAMINATION. Prog. Fish-Cult., 36(4): 195.

19136. Schoettger, R. A. (U. S. Fish & Wildl. Service, Fish Pesticide Res. Lab., Route 1, Columbia, Missouri 65201). 1973. POND ECOLOGY AND PRODUCTION AS AFFECTED BY SIMAZINE. U. S. Dept. of the Interior, Progress in Sport Fishery Research 1971, p. 6; Weed Abstracts, 23(12) abstract 2892, 1974.

Simazine at 1-3 mg/litre, applied before weed emergence, controlled submersed aquatic vegetation; benthic organisms associated with vegetation were reduced but populations of burrowing benthos increased and the amount of phytoplankton chlorophyll was 2-10 times that in the control. Simazine residues persisted in water and mud for at least 1 year but simazine had no adverse effect on bluegills.

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U. S. administration.